

WEEKLY CLIMATE BULLETIN

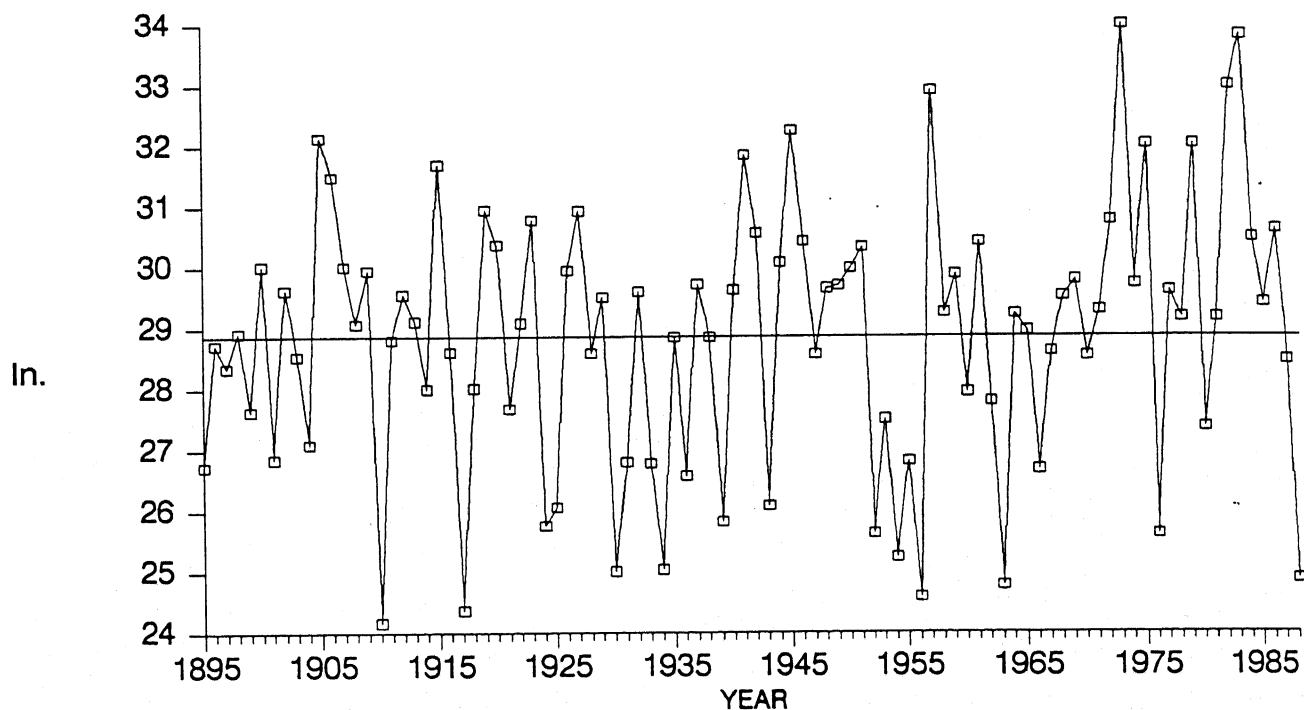
No. 89/02

Washington, DC

January 14, 1989

NATIONAL PRECIPITATION

ANNUAL, 1895-1988



National Climatic Data Center, NOAA

PRELIMINARY PRECIPITATION DATA FROM THE NATIONAL CLIMATIC DATA CENTER (NCDC) HAS RANKED 1988 AS THE FIFTH DRIEST YEAR DURING THE PAST 94 YEARS (SINCE 1895) FOR THE UNITED STATES. FOR FURTHER DETAILS, REFER TO THE 1988 ANNUAL CLIMATE REVIEW STARTING ON PAGE 11.

UNITED STATES DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE - NATIONAL METEOROLOGICAL CENTER

GLOBAL CLIMATE HIGHLIGHTS

MAJOR CLIMATIC EVENTS AND ANOMALIES AS OF JANUARY 11, 1992

North America:

MORE PRECIPITATION ACROSS CALIFORNIA.

Pacific frontal system early in the week dumped more heavy rain (50 mm) across the Pacific seaboard and heavy snow in the higher elevations, easing moisture shortages. Heavy rains flooded freeways and caused mudslides that blocked a number of roads in Southern California. Heavy rains ended short term moisture shortages in southern California, but week deficits still prevailed from parts of northern California into western Canada [Ending after 10 weeks].

Central and West-Central North America:

TEMPERATURES REMAIN ABNORMALLY HIGH.

Unusually mild weather has persisted from the Canadian Rockies westward into the central Plains and middle Mississippi Valley since December (see page 6). Last week, temperatures averaged as much as 5°C above normal in central Canada and highs above 10°C were reported as far north as the eastern slopes of the southern Canadian Rockies [5 weeks].

South and Southern Texas:

RAIN AGGRAVATES FLOODING.

Only light rain fell across central Texas, allowing flood waters to rise in the upper portions of the Trinity, Brazos, and Colorado Rivers, which drenched the southeastern corner of the state. Up to 190 mm of rain at some locations, aggravating flooding along the lower portions of the rivers (see Figure 1). Twenty-eight Texas counties have been declared disaster areas, according to press reports [12 weeks].

Gulf Coast, Southern Georgia, and Florida:

RELIEVE DRYNESS ALONG CENTRAL GULF COAST.

Heavy rains (25 - 100 mm) soaked the central Gulf Coast, relieving long-term dryness. Little or no rain, however, fell across Florida and Georgia, where abnormally dry conditions continued. Since early December, much of Florida and southern Georgia have accumulated deficits of 50 - 117 mm [14 weeks].

Puerto Rico:

TORRENTIAL RAINS INUNDATE ISLAND.

Rains of up to 250 mm drenched Puerto Rico early in the week, causing landslides and spawning mudslides that washed away houses, cars, and other property. The two hardest hit cities were Toa Baja, 20 miles west of San Juan, and Cayey, in the southern part of the island. The floods took 17

lives, left 150,000 without electricity, and caused an estimated \$200 million in damages, according to press reports [Episodic Event].

East-Central South America:

DOWNPOURS INUNDATE NORTHERN ARGENTINA.

Drier weather prevailed over southern Brazil, Uruguay, and extreme northeastern Argentina as light to moderate rains (10 - 40 mm) were widely scattered, providing relief from the wet conditions that had plagued the region. Heavy rains of up to 300 mm, however, inundated parts of north-central Argentina early in the week, generating severe flooding and mudslides. At least 30 people were killed when the Noguine and Soto Rivers, located north of Cordoba, overflowed their banks [7 weeks].

Northeastern and Central Africa and the Middle East:

CHILLY WEATHER REMAINS ENTRENCHED.

Weekly temperatures again ranged from 3°C to 9°C below normal from the eastern Mediterranean into central Africa and the Persian Gulf as a severe cold snap continued to grip the region. The Arctic outbreak claimed 17 lives in Nigeria's northern city of Kaduna when temperatures dropped to near freezing early in the week [7 weeks].

The Middle East:

DRY WEATHER RETURNS.

Little or no precipitation fell, allowing the area to recover from a New Year's Day storm that paralyzed the region [Ending after 6 weeks].

Southern Africa:

DRY WEATHER PREVAILS.

Widely scattered showers (up to 30 mm) relieved dryness in parts of Zimbabwe, southern Mozambique, and northern South Africa. However, little or no rain fell on much of the region as moisture deficits of 50 - 164 mm have accumulated since early December. The dry and warm weather are stressing South Africa's corn crop, according to press reports [6 weeks].

Northern India, Bangladesh, Central China:

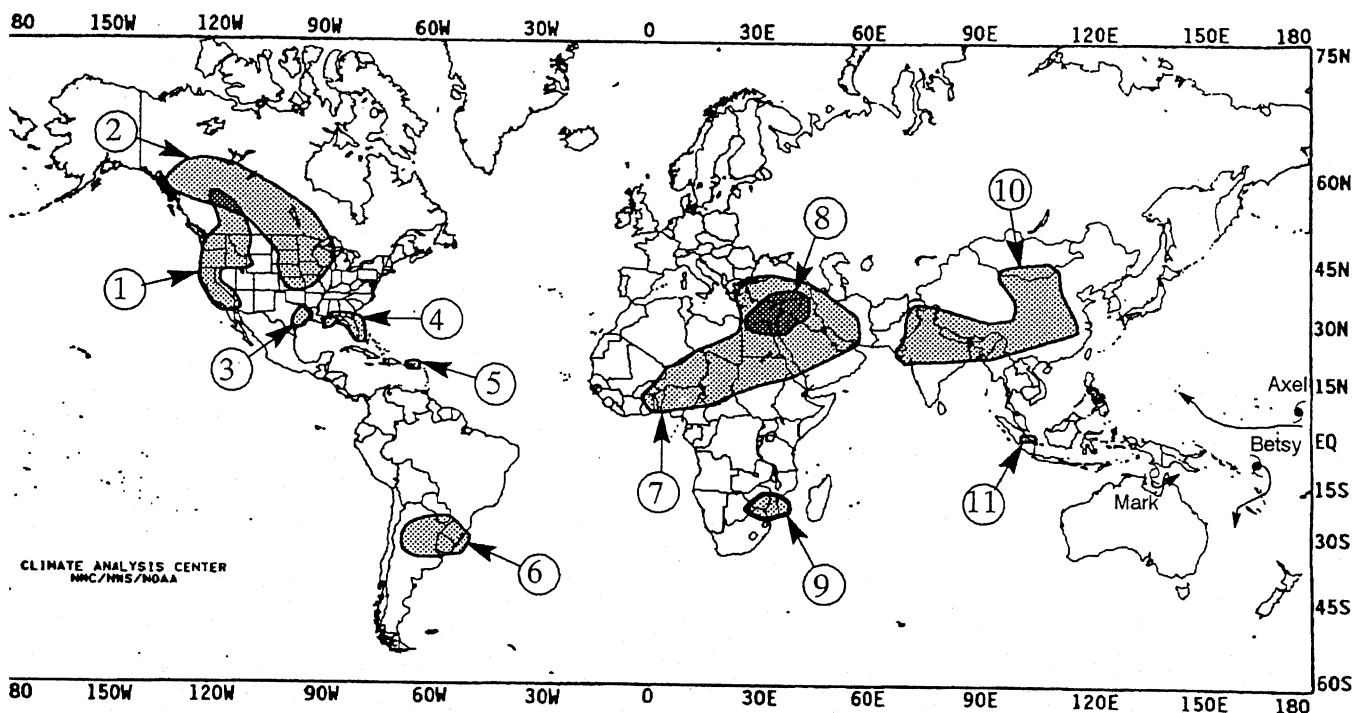
SEASONABLE TEMPERATURES RETURN.

Temperatures averaged only slightly below normal from eastern Pakistan eastward to central China and southern Mongolia as the region recovered from the recent cold conditions [Ending after 3 weeks].

Western Indonesia:

HEAVY FLOODING IN EAST SUMATRA.

Torrential downpours for several days caused rivers to overflow in Jambi province on the island of Sumatra. Six deaths were attributed to the flooding, according to press reports [Episodic Event].



EXPLANATION

KT: Approximate duration of anomalies is in brackets. Precipitation amounts and temperature departures are this week's values.
P: Approximate locations of major anomalies and episodic events are shown. See other maps in this Bulletin for current two week temperature anomalies, four week precipitation anomalies, long-term anomalies, and other details.

UNITED STATES WEEKLY CLIMATE HIGHLIGHTS

FOR THE WEEK OF JANUARY 5 – 11, 1992

A major winter storm battered much of the Far West, Rockies and Great Plains, generating nearly 3 feet of snow, wind gusts to 50 mph, and wind chills to -30°F. The storm dumped heavy snow in the Siskiyou and Sierra Nevadas, and heavy rain in the lower elevations of California. Mud and rock slides closed some roads in southern California while flooding was reported in the San Joaquin Valley. Nearly 3 inches of rain was measured in 12 hours Sunday at Mount Wilson while 2 inches fell to the north of Los Angeles. Up to 15 inches of snow covered the Siskiyou as portions of I-5 were closed by heavy snow. According to press reports, snow pack in the Sierra Nevada is only about 62% of normal, despite the additional snowfall this week. Meanwhile, heavy snow blanketed a large portion of the Rockies and Great Plains. Thirty-two inches of snow buried Elk Meadows, UT while nearly two feet was reported in eastern Colorado. The heavy snow closed several roads in Colorado and Wyoming and forced the cancellation of numerous flights at Denver's Stapleton Airport. Strong wind gusts combined with the snow to produce "white-out" conditions in southeastern Wyoming. Cheyenne, WY reported 14 inches of snow from the storm the greatest January total in 71 years. Farther south, thunderstorms raked parts of the Southwest, spawning tornadoes in Arizona on Monday. Farther east, heavy rain soaked portions of the lower Mississippi Valley and already-saturated eastern Texas. Lake Jackson, TX recorded more than 5 inches of rain while up to 4 inches drenched southwestern Louisiana, causing flash floods. Downstream flooding continued to plague southeast Texas with 3 more counties declared disaster areas, bringing the total in the last month to 28, according to press reports. Elsewhere, some locations in the upper Midwest experienced the first rays of sunshine in 1992. On Thursday, Minneapolis, MN ended a record 350 consecutive hours of overcast skies, dating back to December 25, 1991.

The week began with another storm moving into the Far West. Heavy rain fell along the Pacific Coast while heavy snow blanketed the mountains. The system tracked into the Great Basin by Monday, dumping heavy snow from northern Arizona to eastern Utah. Nearly two feet of snow was measured at Austin, NV while strong wind gusts caused blowing and drifting snow in Utah. To the south of the system, thunderstorms pounded the Southwest. Two tornadoes touched down in Arizona on Monday, one near Phoenix and the other in Mesa, causing damage. The storm eventually moved east, dumping heavy snow on the Rockies. Denver, CO reported a January 24-hour snowfall record after 14.5 inches blanketed Stapleton International Airport from early Tuesday through early Wednesday. Snow measuring nearly two feet was reported in suburban Denver, CO. Numerous roads in eastern Colorado and southeastern Wyoming were closed after 55 mph wind gusts generated blizzard-like conditions. Elsewhere, downstream flooding continued to force some residents from their homes and closed roads in southeast Texas.

The storm and trailing cold front moved from the Rockies into the Great Plains by midweek, dropping over half a foot of snow in the northern Dakotas. Strong thunderstorms erupted along and ahead of

the cold front as it moved from the southern Plains into the Mississippi Valley. Over 3 inches of rain soaked eastern Texas and southwestern Louisiana on Wednesday. Galveston and Port Arthur, TX both measured over 3 inches of rain on Wednesday while St. James Parish, LA recorded more than 4 inches, causing localized flooding. By late Thursday the storm in the nation's midsection had trekked into southern Canada, depositing heavy snow in the upper Midwest and Great Lakes while freezing rain glazed the lower Great Lakes. Behind the storm system, a shot of Arctic air plunged temperatures to those more typical of January in the north-central U.S. with sub-zero lows reported from Nebraska to Minnesota. International Falls, MN recorded its first below-zero reading in three weeks when the mercury fell to -3°F Thursday morning. However, abnormally warm conditions returned to the north-central U.S. by the weekend with more than a dozen record highs on Friday and Saturday from Montana to Iowa as readings topped 50°F. Farther south, floodwaters started to recede in southeast Texas. Meanwhile, wintry weather moved into the Pacific Northwest in advance of a cold front with heavy snow blanketing the Cascade and Olympic mountain ranges. Elsewhere, a low in northern Mexico produced snow in western Texas early Saturday with 3 inches reported at El Paso and up to 8 inches in the Guadalupe Pass area.

According to the River Forecast Centers, the greatest weekly precipitation totals (more than 2 inches) occurred in southeast Texas, the lower Mississippi Valley, the Southwest, southeast Alaska, and scattered locations in northern and central California, western Washington, and northern Maine (Table 1). Light to moderate amounts were measured across most of New England, the Great Lakes, the Ohio, Tennessee, and Mississippi Valleys, eastern Dakotas, central Plains, Texas, the Rockies, the West, southern and central Alaska, and eastern Hawaii. Little or no precipitation fell in the mid-Atlantic, the coastal Plains of the Carolinas and Georgia, Florida, south-central Great Plains, northern High Plains, and the remainders of Alaska and Hawaii.

Abnormally warm weather continued across the north-central states for the fifth consecutive week (Table 2). Weekly departures between +16°F and +21°F stretched from Montana to Wisconsin, despite a brief blast of frigid Arctic air about midweek in the upper Midwest. Departures of +5°F to +15°F were common in the northern Rockies, central and southern Plains, Ohio, Tennessee, and Mississippi Valleys, the Great Lakes, mid-Atlantic, and New England. Near to slightly above normal temperatures were observed in the south Atlantic, most of Texas, the southern and central High Plains, and the Pacific Northwest. Unusually mild conditions also dominated Alaska with weekly departures exceeding +5°F reported across most of the state.

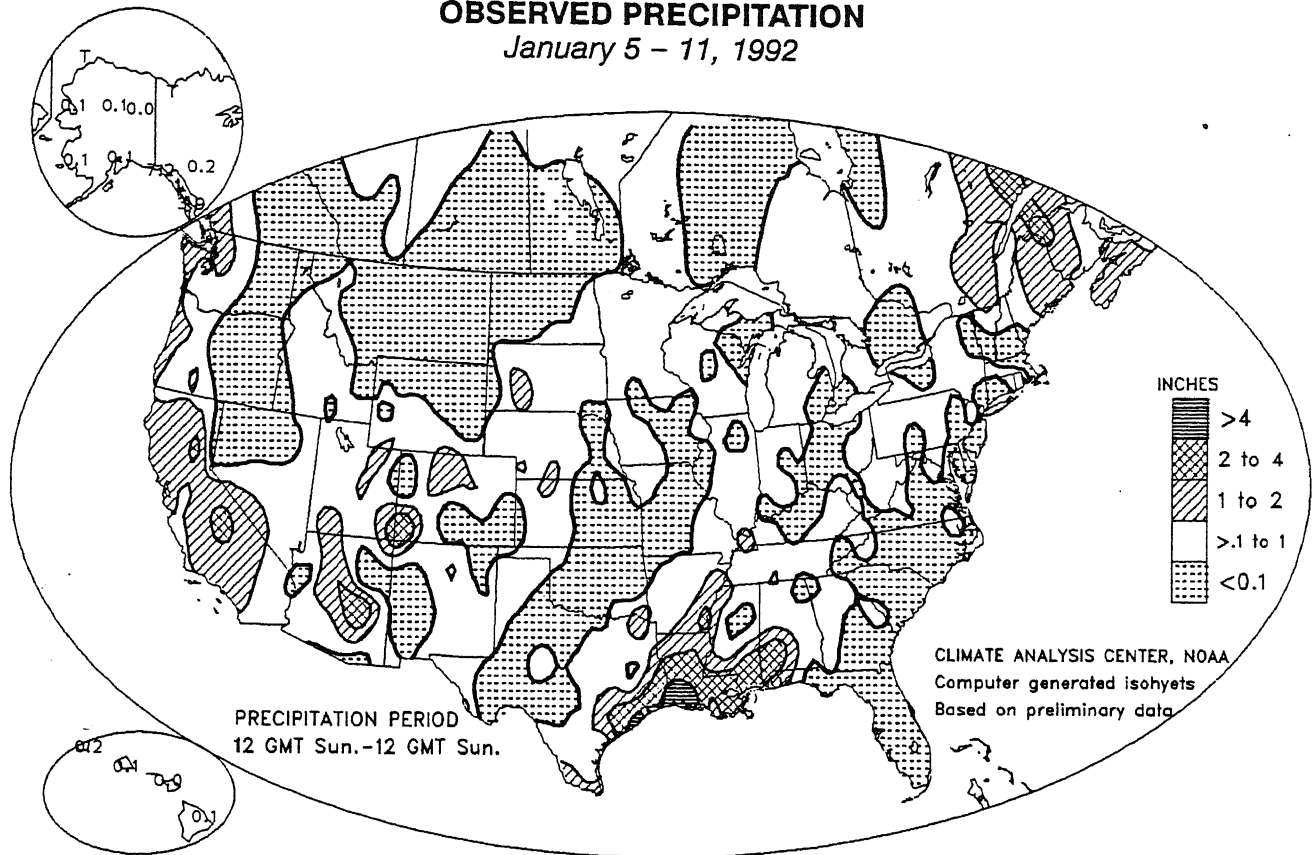
Colder than normal weather was confined to California, the Great Basin, and Florida (Table 3). Weekly departures to -6°F were observed in the Great Basin while departures to -4°F were recorded in north-central Florida where readings dropped to freezing during the week. In Alaska, slightly below normal conditions were confined to the Aleutians.

TABLE 1. SELECTED STATIONS WITH 2.00 OR MORE INCHES OF PRECIPITATION DURING THE WEEK OF JANUARY 5 – 11, 1992

STATION	TOTAL (INCHES)	STATION	TOTAL (INCHES)
UTAH, AK	7.17	KODIAK, AK	2.66
KE CHARLES, LA	4.92	NEW ORLEANS NAS, LA	2.61
VESTON, TX	4.00	PORT ARTHUR, TX	2.44
NETTE ISLAND, AK	3.94	NEW ORLEANS/LAKE FRONT, LA	2.20
AYETTE, LA	3.25	NEW ORLEANS/MOISANT, LA	2.13
RDOVA/MILE 13, AK	2.92	QUILLAYUTE, WA	2.09

OBSERVED PRECIPITATION

January 5 - 11, 1992



DEPARTURE OF AVERAGE TEMPERATURE FROM NORMAL (°F)

January 5 - 11, 1992

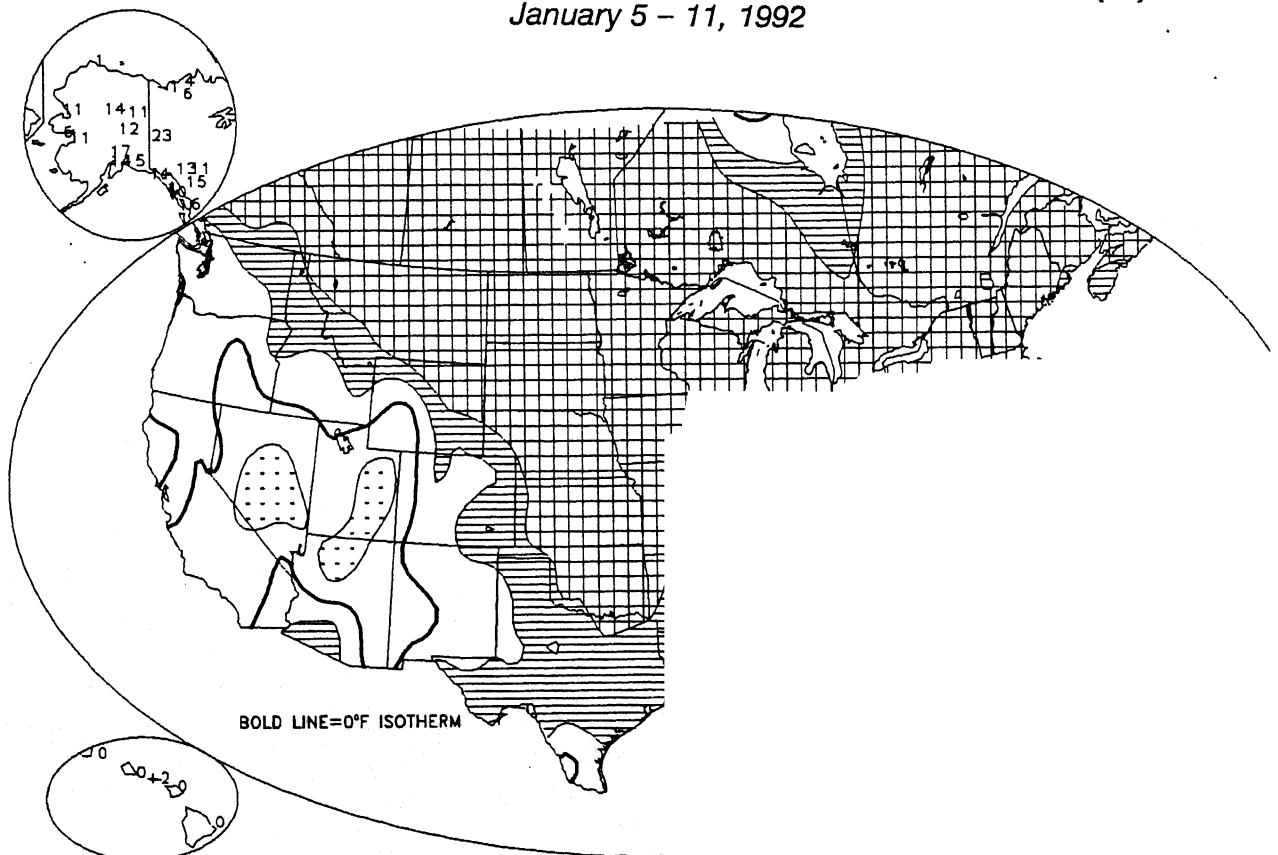


TABLE 2. SELECTED STATIONS WITH TEMPERATURES AVERAGING 16.5°F OR MORE ABOVE NORMAL FOR THE WEEK OF JANUARY 5 - 11, 1992

<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)	<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)
NORTHWAY, AK	+24.4	1.9	HURON, SD	+17.2	28.6
INTERNATIONAL FALLS, MN	+20.8	21.1	TALKEETNA, AK	+17.2	24.9
MINOT, ND	+20.2	26.4	CORDOVA/MILE 13, AK	+17.1	38.0
KENAI/MUNI, AK	+19.9	29.3	SIOUX CITY, IA	+17.1	33.3
WILLISTON, ND	+19.3	26.3	ST CLOUD, MN	+17.1	24.6
JAMESTOWN, ND	+18.4	23.8	NORFOLK, NE	+16.9	34.4
ROCHESTER, MN	+18.2	28.0	LINCOLN/MUNI, NE	+16.8	36.5
GRAND FORKS, ND	+18.1	20.4	MASON CITY, IA	+16.8	29.4
DULUTH, MN	+18.0	24.9	MINNEAPOLIS, MN	+16.8	28.1
HAVRE, MT	+17.9	29.6	EAU CLAIRE, WI	+16.8	26.9
BIG DELTA, AK	+17.9	10.7	ALEXANDRIA, MN	+16.8	22.5
DICKINSON, ND	+17.8	28.8	GREEN BAY, WI	+16.6	31.2
BISMARCK, ND	+17.5	24.4	OTTUMWA, IA	+16.5	36.4
WATERLOO/MUNI, IA	+17.4	31.8	SPENCER, IA	+16.5	29.2

TABLE 3. SELECTED STATIONS WITH TEMPERATURES AVERAGING 2.0°F OR MORE BELOW NORMAL FOR THE WEEK OF JANUARY 5 - 11, 1992

<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)	<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)
ALAMOSA, CO	-10.1	4.8	GAINESVILLE, FL	-3.5	54.0
CALIENTE, NV	-5.9	25.7	ADAK, AK	-3.3	30.1
PRICE, UT	-4.6	17.5	FLAGSTAFF, AZ	-2.6	25.4
TONOPAH, NV	-4.4	25.9	ELY, NV	-2.4	21.7
LONG BEACH, CA	-4.1	51.5	DAGGETT, CA	-2.1	45.4
PRESCOTT, AZ	-3.6	34.0	ELKO, NV	-2.0	22.0

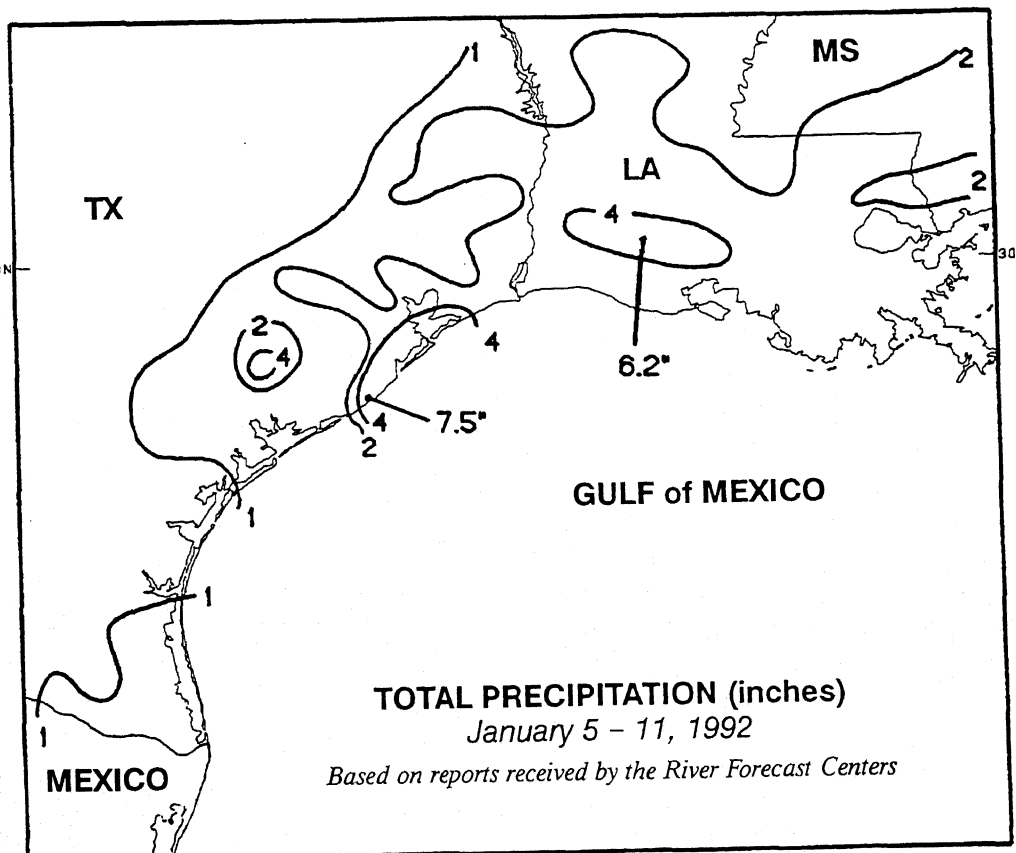
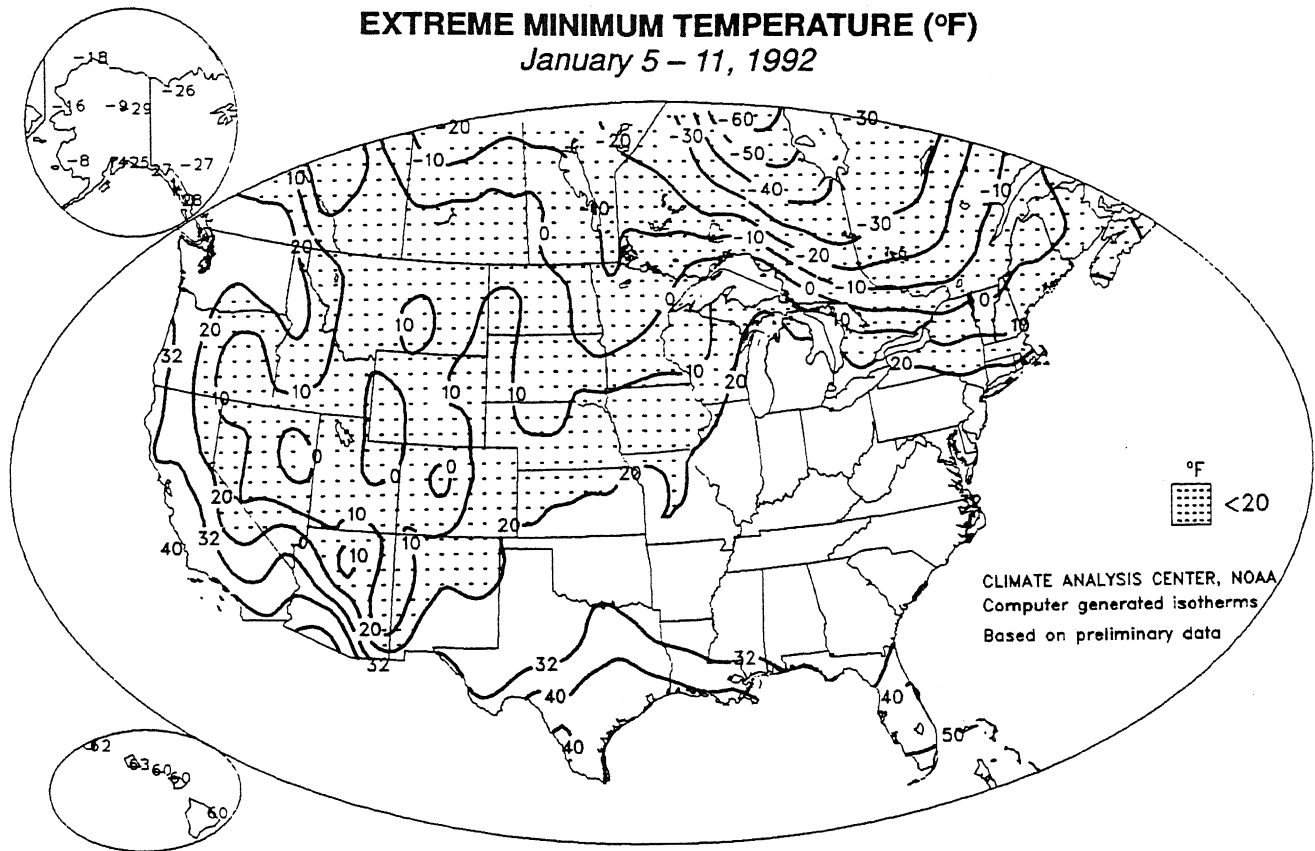


FIGURE 1. Moderate to heavy rains (up to 7.5 inches) in southeastern Texas aggravated flooding along the lower portions of the Colorado, Brazos, and Trinity Rivers. Heavy rains also drenched southern Louisiana, generating flash flooding, according to the Office of Hydrology. Wetness across Texas and the lower Mississippi Valley corresponds to anomaly patterns typically found at this time of year during the mature phase of a low-index (warm) ENSO episode (see pages 25 - 26), which favors above normal October - March precipitation in the region.

EXTREME MINIMUM TEMPERATURE (°F)

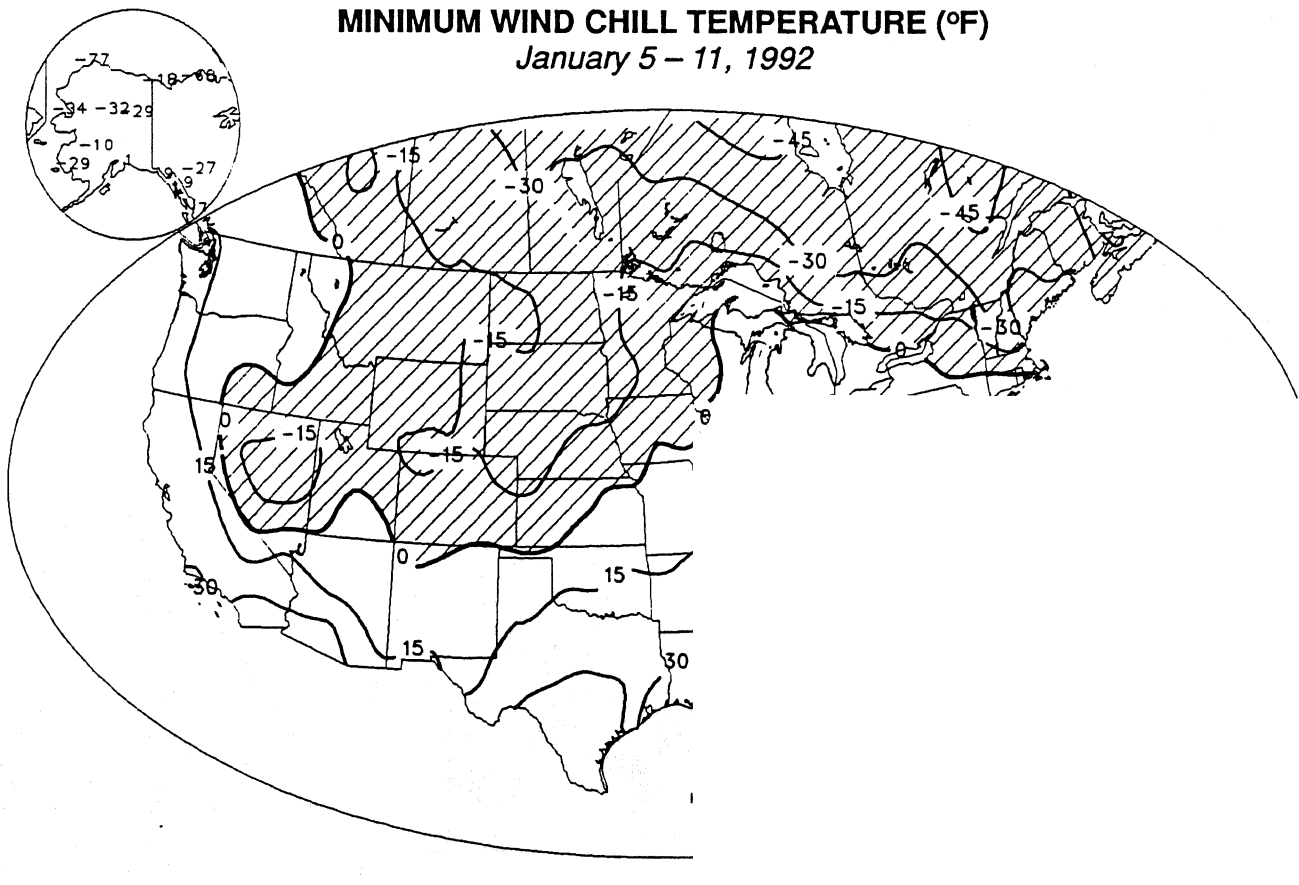
January 5 – 11, 1992



Cold conditions affected most of the nation at some point during the week, with subfreezing temperatures reaching the east-central Gulf Coast (top). A mid-week blast of Arctic air combined with strong winds to produce dangerous wind chills (<15°F) in the Great Basin, central Rockies, and northern and central Plains (bottom).

MINIMUM WIND CHILL TEMPERATURE (°F)

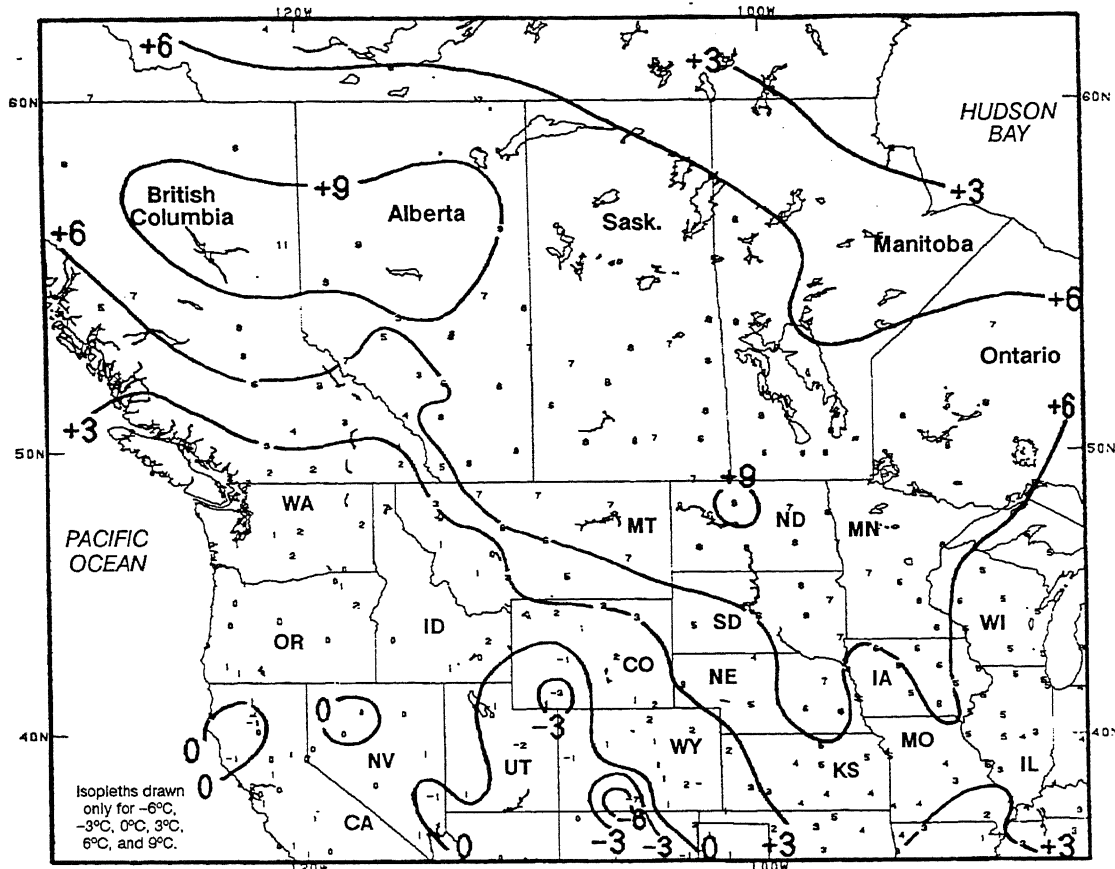
January 5 – 11, 1992



GLOBAL CLIMATE HIGHLIGHTS FEATURE

DEPARTURE FROM NORMAL AVERAGE TEMPERATURE (°C)

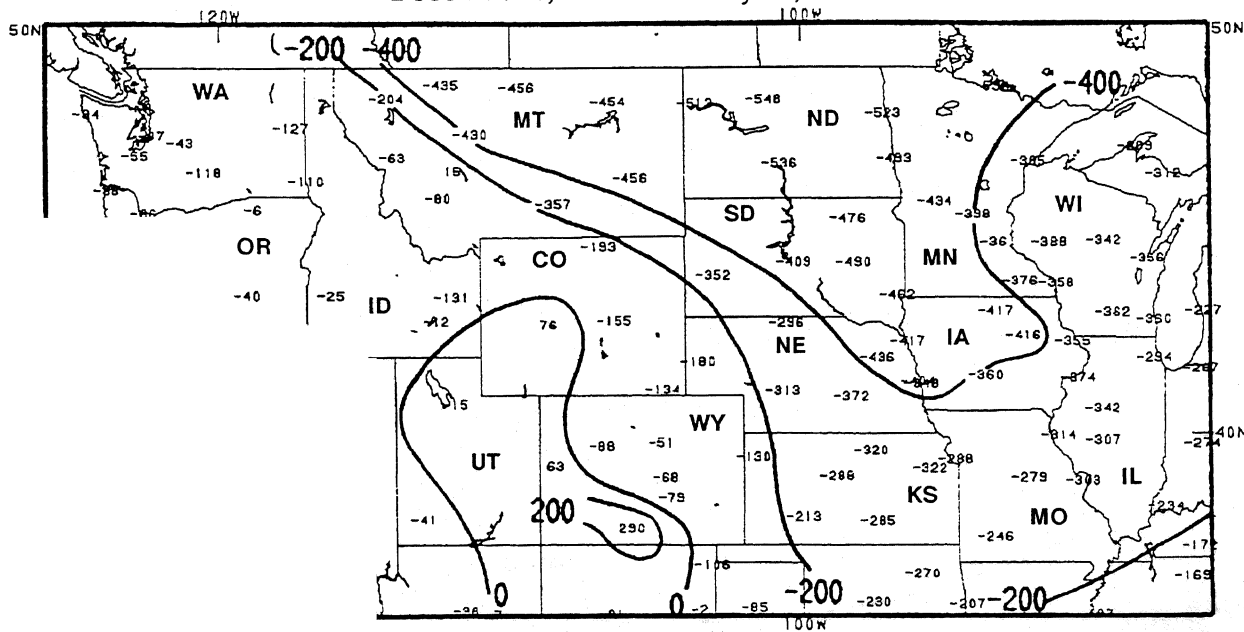
December 8, 1991 - January 11, 1992



A prolonged period of exceptionally mild weather has encompassed southwestern and south-central Canada and the north-central and northwestern United States since early December, with temperatures averaging 9°C to 11°C above normal across portions of northeastern British Columbia and northern Alberta (top). This temperature pattern corresponds well with anomalous December - March warmth that typically affects the region during low-index (warm) ENSO episodes. The mild spell has resulted in much below normal heating demand across the northern Plains, where some locations have recorded 500-550 fewer HDD's than normal (bottom).

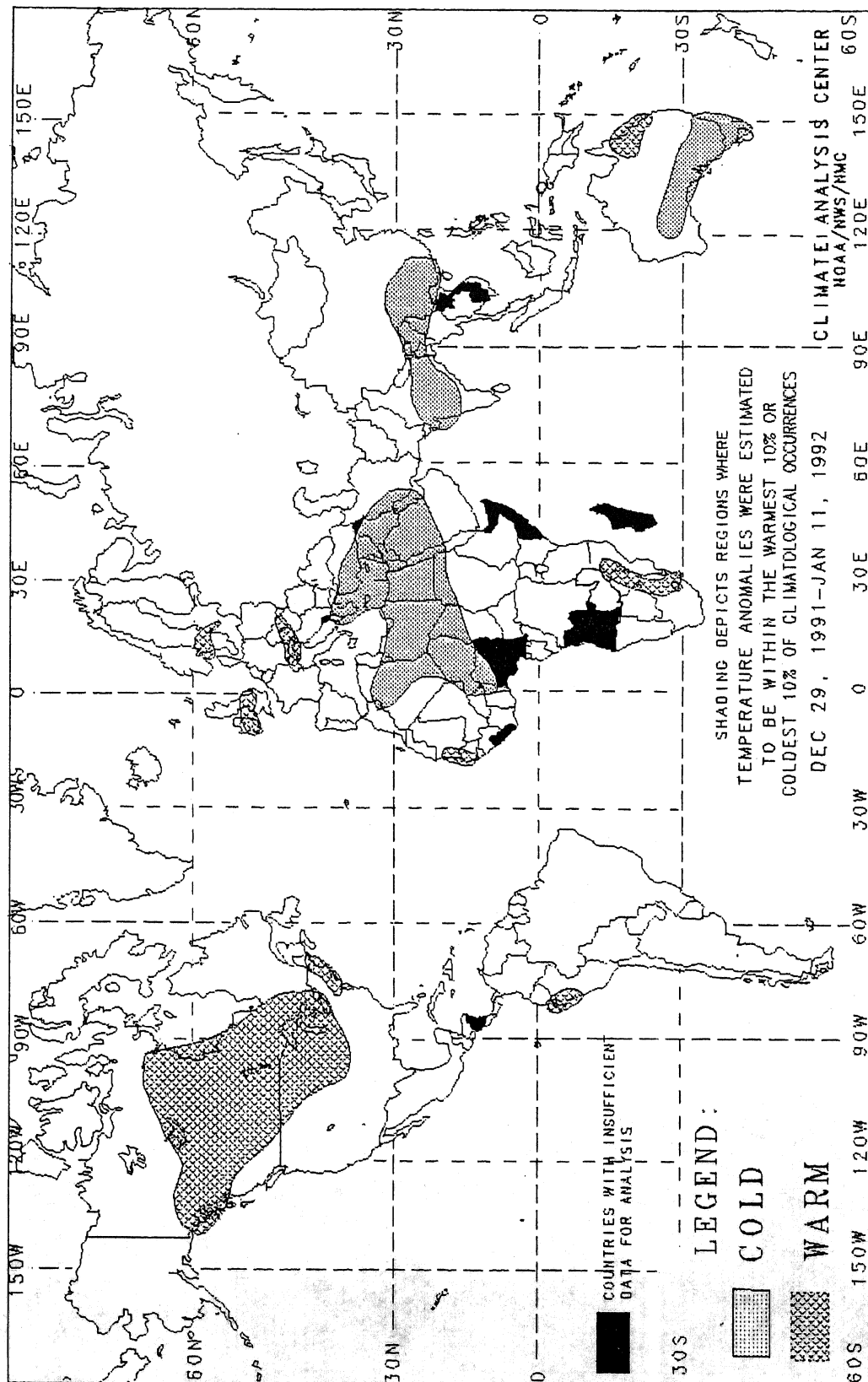
DEPARTURE FROM NORMAL HEATING DEGREE DAYS

December 8, 1991 - January 11, 1992



2-WEEK GLOBAL TEMPERATURE ANOMALIES

DECEMBER 29, 1991 – JANUARY 11, 1992



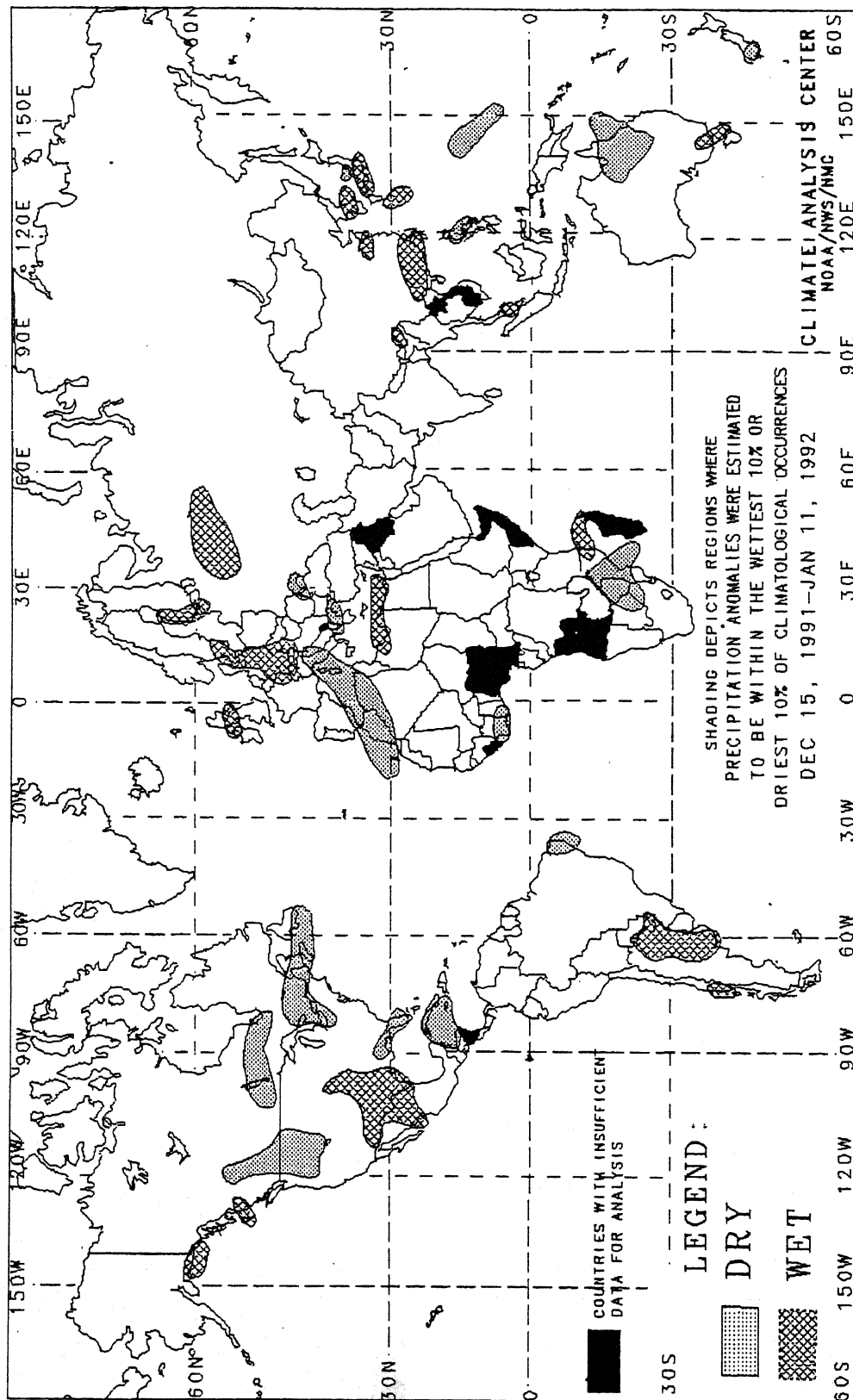
The anomalies on this chart are based on approximately 2500 observing stations for which at least 13 days of temperature observations were received from synoptic reports. Many stations do not operate on a twenty-four hour basis so many night time observations are not taken. As a result of these missing observations the estimated minimum temperature may have a warm bias. This in turn may have resulted in an overestimation of the extent of some warm anomalies.

Temperature anomalies are not depicted unless the magnitude of temperature departures from normal exceeds 1.5°C.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

This chart shows general areas of two week temperature anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

DECEMBER 15, 1991 – JANUARY 11, 1992



The anomalies on this chart are based on approximately 2500 observing stations for which at least 27 days of precipitation observations (including zero amounts) were received or estimated from synoptic reports. As a result of both missing observations and the use of estimates from synoptic reports (which are conservative), a dry bias in the total precipitation amount may exist for some stations used in this analysis. This in turn may have resulted in an overestimation of the extent of some dry anomalies.

In climatologically arid regions where normal precipitation for the four week period is less than 20 mm, dry anomalies are not depicted. Additionally, wet anomalies for such arid regions are not depicted unless the total four week precipitation exceeds 50 mm.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

The chart shows general areas of four week precipitation anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

ANNUAL CLIMATE SUMMARY

MAJOR CLIMATIC EVENTS AND ANOMALIES IN THE UNITED STATES DURING 1991

1. The East:

A HOT, DRY SUMMER.

An early season heat wave baked much of the region during late May and early June, with weekly temperature departures reaching $+7^{\circ}\text{C}$. Cooler weather dominated during most of June, but extensive dryness developed from the Corn Belt to the Atlantic Seaboard. Beneficial rains fell in early July, then recurrent heat waves in middle and late July aggravated the abnormally dry conditions. Cooler weather and widespread light rain in early August provided limited relief. Dryness, however, returned for the rest of August, except for Hurricane Bob's trek along the Atlantic Coast. More hot weather baked the region early in September, but a sharp cold wave around mid-month abruptly ended the warm and dry conditions. The largest moisture deficits accumulated from eastern Ohio southeastward to northern Maryland, where some locations measured less than 50% of normal rainfall during April through September.

2. Northwestern and Central States:

EXCESSIVE PRECIPITATION PLAGUES REGION.

Heavy precipitation inundated much of the central United States from April through June. Many areas in the lower Mississippi Valley received two to five times their normal precipitation during April and early May, and Louisiana was declared a major disaster area. By June, sizable precipitation surpluses covered patches of the Northwest and Southeast and were widespread throughout the central states. By mid-June, excessive rainfall was limited to the southeastern quadrant of the country and by July near normal conditions prevailed. Recurrent excessive rains across the Louisiana Bayous helped push local annual totals to over 2500 mm for 1991.

3. Southern and Eastern States:

THE YEAR STARTS OUT WET.

1991 began with heavy rains and widespread flooding in the Ohio, Tennessee, and Mississippi Valleys that spread into much of the East. The precipitation abated in the Northeast by the middle of January; however, the Gulf Coast continued to receive excessive rains. The Southeast enjoyed a brief period of dry weather during the middle of February, but more heavy precipitation returned by the end of the month. Precipitation surpluses finally began diminishing in March.

4. Southern and Central Plains:

WETTER THAN NORMAL MONSOON SEASON.

Abnormally moist monsoonal flow across the south-central states resulted in torrential downpours during much of August. The cloudbursts caused considerable river and flash flooding in north-central and northeastern Texas. During the second half of August, the High Plains enjoyed a respite from the thunderstorms; however, deluging rains returned in early September. The monsoonal pattern started breaking up by mid-September, and seasonably dry weather finally prevailed in early October.

5. The West:

A FIFTH CONSECUTIVE "RAINY" SEASON IS DRY.

Excessively dry weather prevailed in January and February, months during which many western states rely on heavy precipitation to recharge their water supply. Unfortunately, storms avoided the region, and precipitation deficits grew. The "March Miracle" provided California with its wettest week in five years, and dumped up to 1000 mm of precipitation on some valleys in the Sierra Nevadas, easing precipitation deficits. Cool, stormy weather persisted into April before seasonably dry weather returned.

6. Alaska:

SUMMER COMMENCES WITH RECORD HEAT.

Mild weather engulfed northern Alaska in late April and early May, promoting wildfires. Cooler air enveloped the region in early June, but record heat greeted the first days of summer, with temperatures exceeding 35°C in parts of the interior. Over one hundred wildfires scorched the state in July before cooler air returned.

7. The East:

WARM AND DRY WEATHER ENGENDERS WILDFIRES.

Abnormally mild and excessively dry weather from late August through October promoted the rapid spread of wildfires across central and southern sections of the Appalachians and Piedmont. Over 970 square kilometers of land were scorched in the central and southern Appalachians, with more than 800 square kilometers charred in West Virginia alone. A major ice storm in the second week of November glazed the West Virginia mountains while heavy rains soaked the northern mid-Atlantic region, diminishing the forest fire threat. The southern Appalachians remained dry, with substantial dry conditions persisting during most of the month.

Little or no precipitation fell in the region in September and early October when precipitation totals typically start to increase. The dryness was aggravated by unusually warm weather in mid-October, helping wildfires to destroy over 1,000 square kilometers in the Northwest. The season's first significant rainfall brought some relief at the end of October, and moderate rains in mid-November helped decrease precipitation shortages.

9. Northern and Western States:

ARCTIC OUTBREAKS CHILL THE REGION.

The year began with a massive Arctic outbreak that engulfed much of the western and central part of the nation. Weekly temperature departures plummeted to -14°C before the Arctic air retreated northeastward into Canada. Temperatures dipped below -20°C in the southern Rockies and subfreezing readings reached into Mexico.

Alaska:

A LATE SUMMER DRY SPELL.

able precipitation deficits developed in Alaska during the summer as very dry weather prevailed. Some locations in the northern half of the state received only 25% of normal precipitation. Near normal amounts began falling in some areas by late September, but the northeastern part remained abnormally dry until October.

the Central States:

PERSISTENT WETNESS.

ough short-lived, intense precipitation was not a problem, a large portion of the Plains, Midwest, and Great Lakes received consistently above normal precipitation during most of November, with the north-central states enduring abnormally wet weather beginning in September. Several stations in Minnesota established new monthly and monthly snowfall records in November. Wet conditions persisted through December, with the heaviest precipitation falling on the southern Great Plains.

the West:

SIXTH CONSECUTIVE SLOW START TO THE RAINY SEASON.

California reported little or no precipitation in late November and December, making 1991-92 the sixth consecutive rainy season to start off slowly. The dry and windy weather fanned brush fires in the Los Angeles area during November. Light rains moistened southern California during the middle of December, and heavier rains fell at the end of the month; however, long-term precipitation deficits remained following more than five years of drought.

the East:

HURRICANE BOB BATTERS NORTH CAROLINA AND NEW ENGLAND.

In late August, Hurricane Bob brushed the southern Atlantic coast as the eye of the storm missed Cape Fear, NC by 65 km. Over 125 mm of rain and 120 mph wind gusts lashed the Outer Banks of North Carolina while the center of the storm, out at sea, packed wind speeds of 185 kph. The hurricane then moved eastward, making landfall on southern Rhode Island. Bob maintained hurricane intensity as it passed just east of Boston before again moving inland near New England, ME and racing northeastward. According to the American Insurance Service Group, Bob ranks second only to Hurricane Hugo in terms of insurance losses (billions of dollars) caused by a hurricane in the United States. Total damage generated by the storm is estimated at billions of dollars.

the West:

HEAVY RAINS CAUSE SEVERE FLOODING.

In much of December, heavy rains drenched much of the southern Plains. Broad sections of Texas received over 100 mm of rain from the storm within one week, with localized amounts reaching 410 mm north of San Antonio. Rainfall abated but remained above normal at some locations as the year drew to a close, causing minor or renewed flooding.

15. The West:

FIRES RESULT FROM HOT, DRY WEATHER AND HIGH WINDS.

Strong winds, with gusts approaching 115 kph, fanned wildfires across much of the northern and central Far West during October. Six weeks of unseasonably hot, dry weather generated copious amounts of dry, easily-ignited vegetation. Eastern Washington, the Idaho Panhandle, and the San Francisco Bay area were particularly hard hit. In addition, the high winds picked up loose, dry soil, causing dust storms in parts of California.

16. Atlantic Coast and the South:

HEAVY RAINS DRENCH REGION.

Severe thunderstorms brought torrential downpours, high winds, and hail to the deep South as cold air plunged through the nation's midsection during late September. The leading edge of the cold air mass also brought heavy rains and severe thunderstorms to New England and the Atlantic coast. Winds gusted up to 150 kph in parts of Boston, MA, and rainfall totals of 100 to 150 mm drenched much of the southern Plains, Southeast, and Atlantic Coast.

17. North-Central States:

BITTER COLD HERALDS EARLY WINTER WEATHER.

A November Arctic outbreak brought bitterly cold air to the north-central states as record-breaking low temperatures penetrated southward to the Gulf of Mexico. Below normal temperatures prevailed from the Rockies eastward to the Atlantic coast and weekly departures reached -15°C in the central states. Measurable snow was observed as far south as Tupelo, MS. Between late October and mid-November, more than 600 daily record lows were established, with many stations setting new records on several consecutive days.

18. The Midwest:

SEVERE WINTER STORM RAGES.

A massive winter storm tore through the Midwest in mid-March, bringing heavy snow, high winds, and/or large accumulations of ice from the west-central Great Plains eastward through the Ohio Valley and Pennsylvania. These dangerous conditions snapped power lines in northern parts of Illinois and Indiana and stranded motorists throughout the region as snow drifts clogged major highways.

19. California:

DUSTSTORM LEADS TO 104-CAR ACCIDENT.

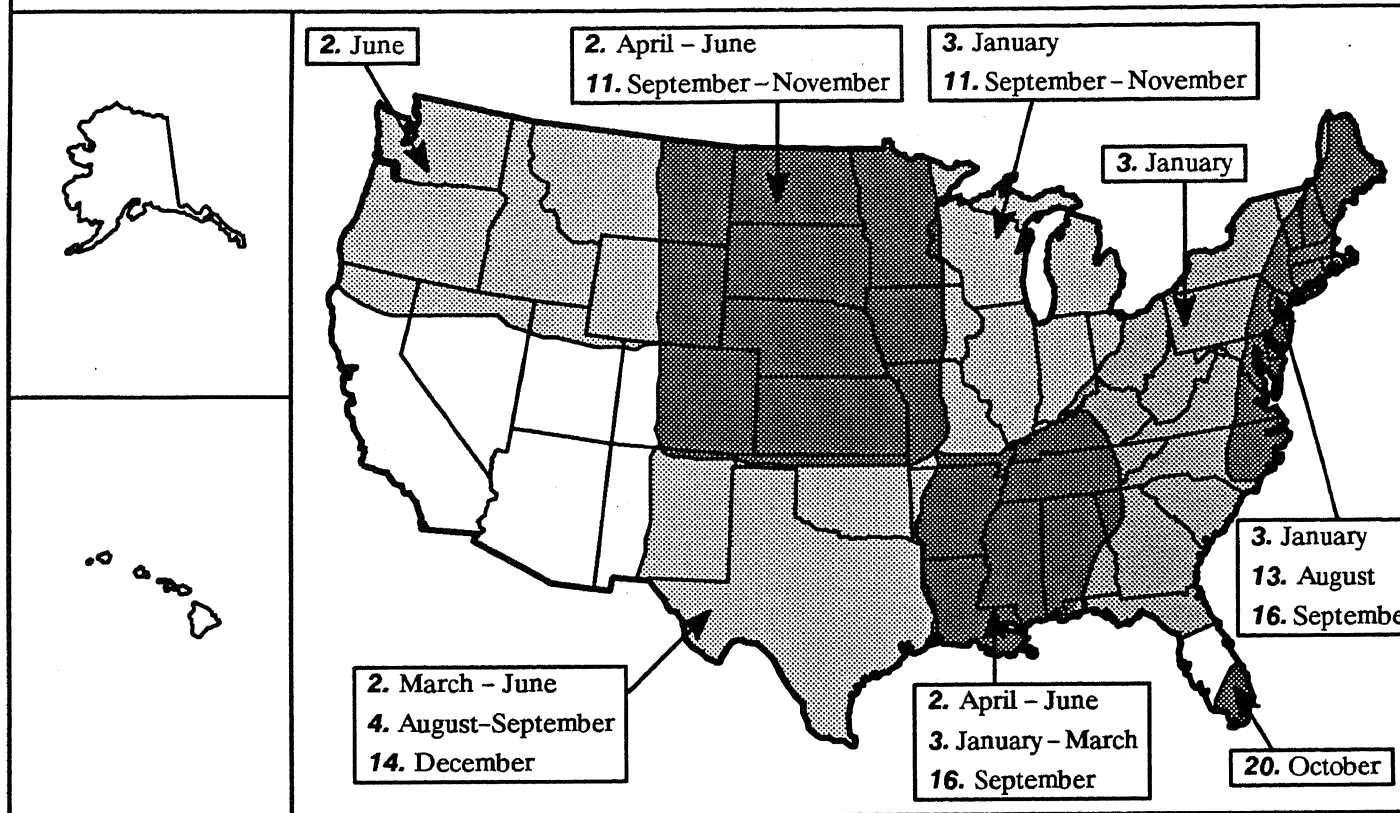
Wind gusts to 100 kph picked up dust from dry, fallow fields in the San Joaquin Valley, reducing visibilities to near zero and causing a chain-reaction 104-car pileup along a two kilometer stretch of Interstate Route 5 near Coalinga, CA. According to press reports, seventeen lives were lost and more than 150 people were injured in the accident.

20. Florida:

HEAVY RAINS INUNDATE THE STATE.

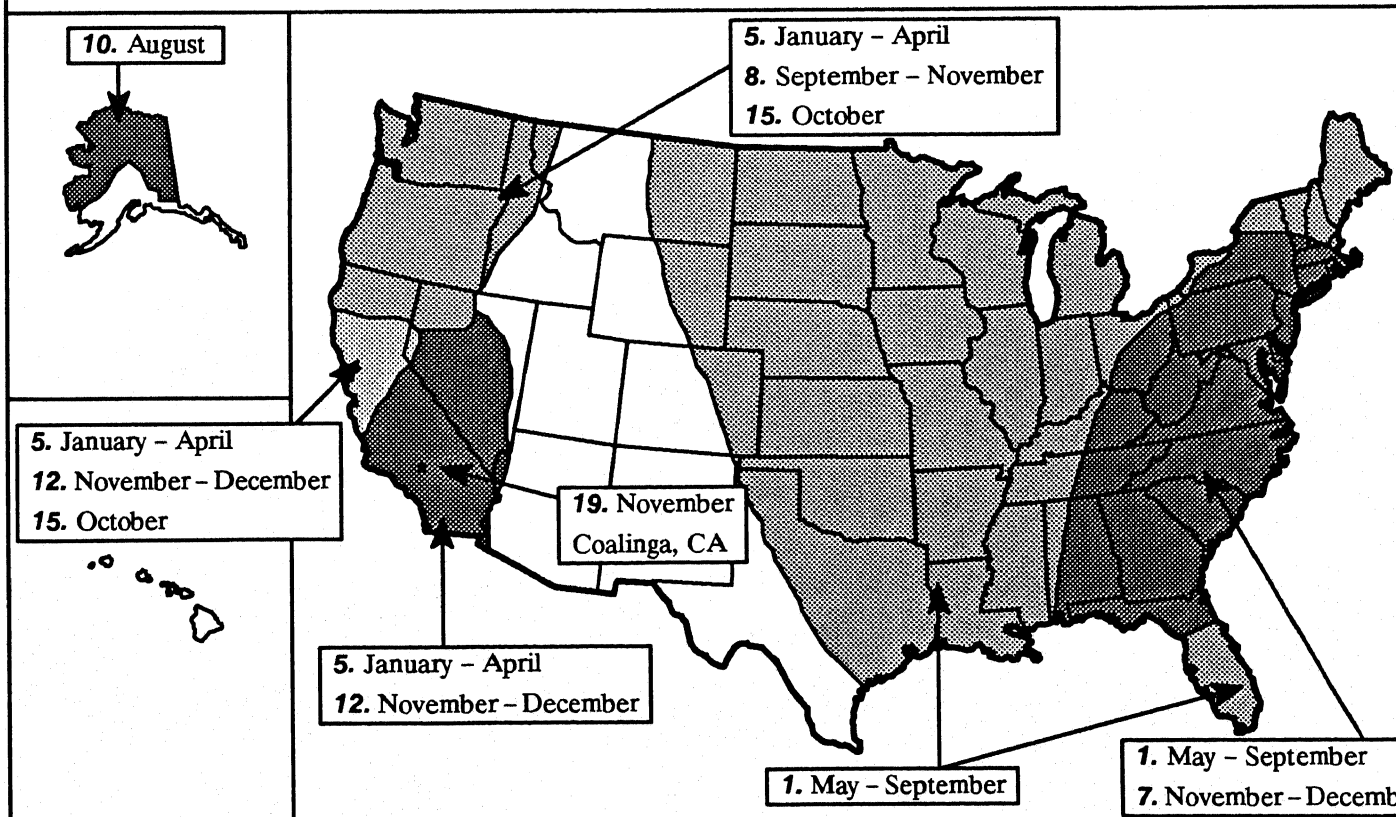
Torrential rains inundated southern Florida with amounts approaching 395 mm. Most of the mid-October rains fell from heavy thunderstorms associated with a stalled front and moisture from Tropical Storm Fabian. The deluge helped bring more typical soggy conditions to the Everglades following three consecutive dry years.

SIGNIFICANT ABOVE NORMAL PRECIPITATION ANOMALIES DURING 1991

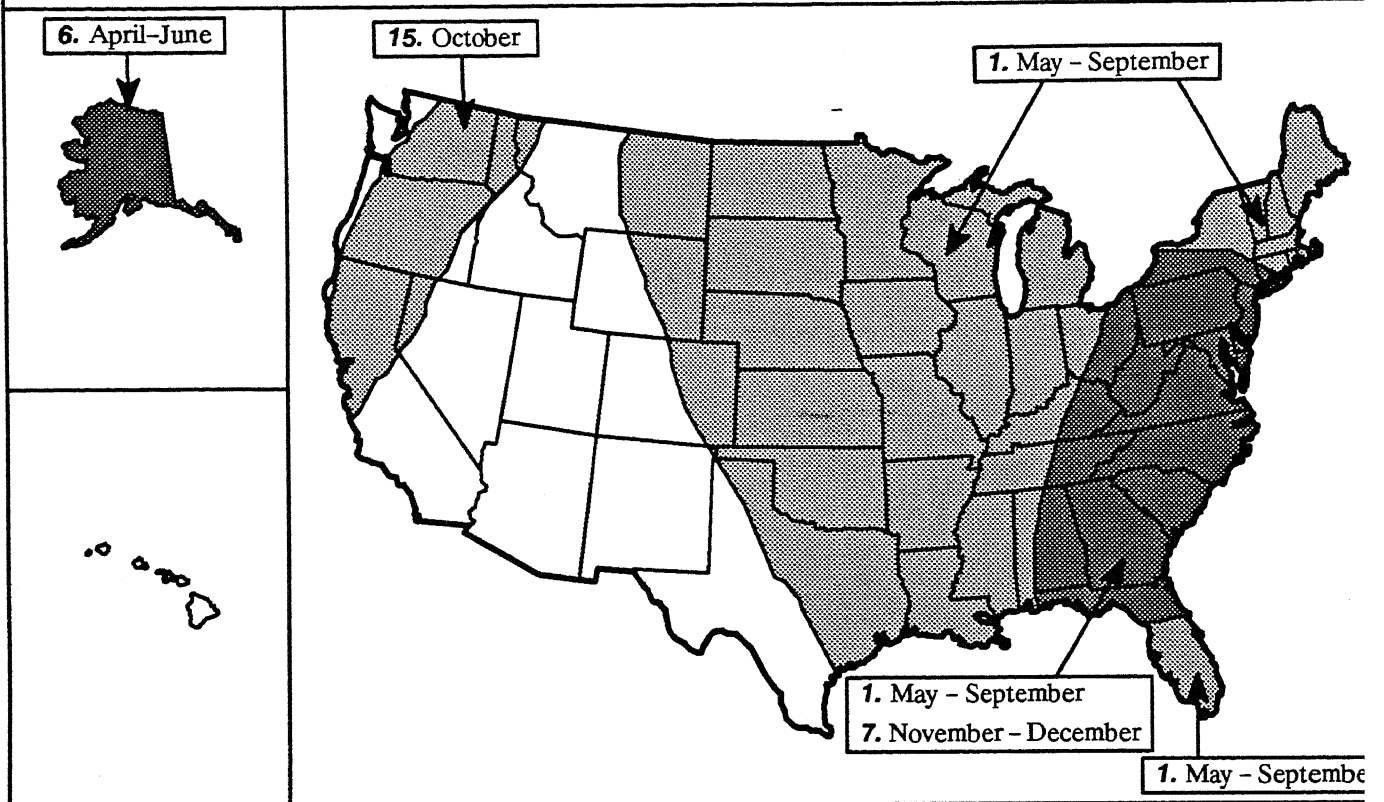


Numbers refer to specific items in the Annual Climate Summary text.

SIGNIFICANT BELOW NORMAL PRECIPITATION ANOMALIES DURING 1991

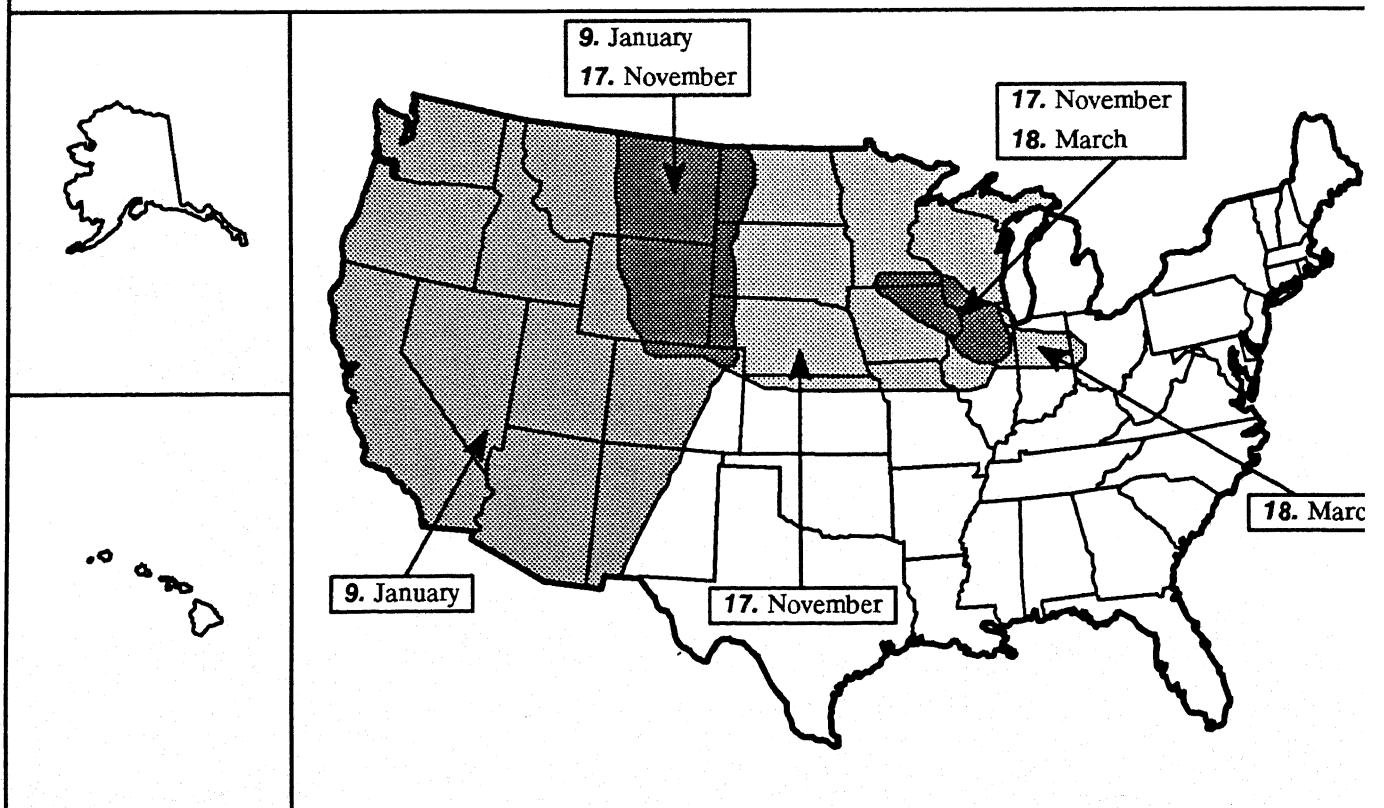


SIGNIFICANT ABOVE NORMAL TEMPERATURE ANOMALIES DURING 1991



Numbers refer to specific items in the Annual Climate Summary text.

SIGNIFICANT BELOW NORMAL TEMPERATURE ANOMALIES DURING 1991



**TEMPERATURE AND PRECIPITATION RANKINGS FOR 1991
 BASED ON THE PERIOD 1895 TO 1991.
 1 = DRIEST/COLDEST AND 97 = WETTEST/HOTTEST.**

<u>REGION</u>	<u>PRECIPITATION</u>	<u>TEMPERATURE</u>
NORTHEAST	24	91
EAST NORTH CENTRAL	95	88
CENTRAL	38	90
SOUTHEAST	81	78
WEST NORTH CENTRAL	75	86
SOUTH	93	71
SOUTHWEST	78	56
NORTHWEST	29	77
WEST	31	72
NATIONAL	81	85

Top Ten Rankings: *ITALICS* Bottom Ten Rankings: **BOLD**

National Climatic Data Center

TOTAL NUMBER OF TORNADOES, U.S.A.

ANNUAL TOTAL 1952-1991

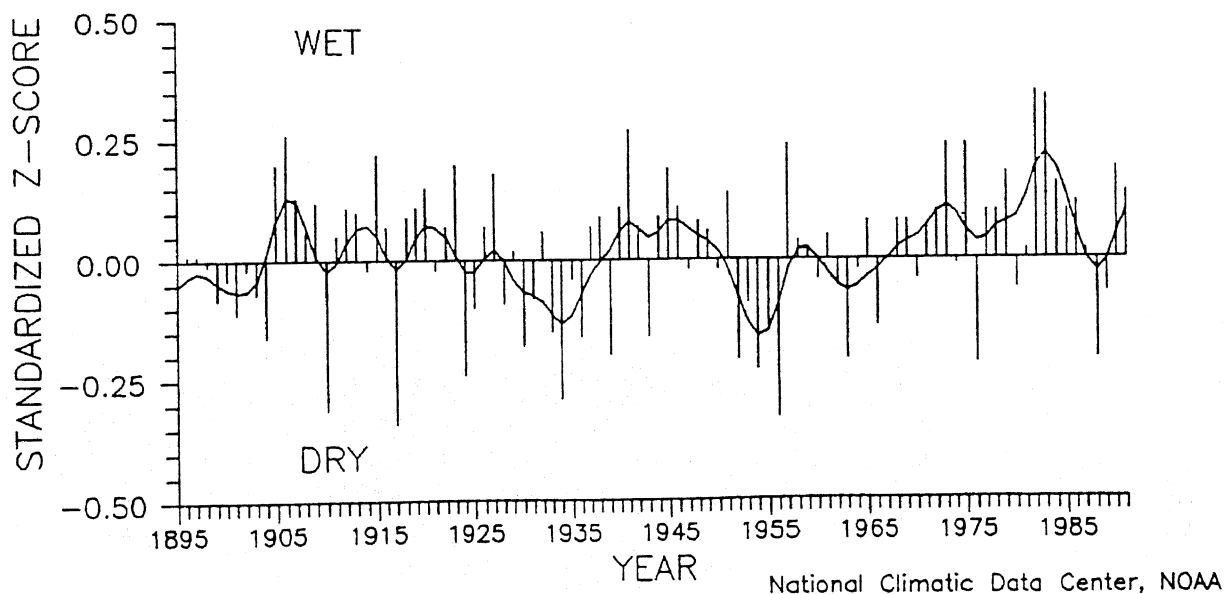
**PRECIPITATION RANKINGS FOR 1991, BASED ON THE
PERIOD 1895 TO 1991. 1 = DRIEST, 97 = WETTEST.**

<u>STATE</u>	<u>RANK</u>	<u>STATE</u>	<u>RANK</u>	<u>STATE</u>	<u>RANK</u>	<u>STATE</u>	<u>RANK</u>
AL	87	IA	86	NE	51	RI	74
AZ	53	KS	21	NV	43	SC	75
AR	80	KY	41	NH	71	SD	83
CA	33	LA	97	NJ	43	TN	84
CO	64	ME	52	NM	93	TX	93
CT	66	MD	6	NY	30	UT	57
DE	50	MA	76	NC	39	VT	51
FL	92	MI	92	ND	77	VA	18
GA	88	MN	94	OH	8	WA	47
ID	33	MS	94	OK	76	WV	24
IL	45	MO	33	OR	20	WI	96
IN	24	MT	76	PA	7	WY	68

Top 10 rankings : **BOLD** Bottom 10 rankings : *Italics*

National Climatic Data Center

U.S. NATIONAL WEIGHTED MEAN PRECIPITATION INDEX
JANUARY–DECEMBER, 1895–1991



Annual National Weighted Mean Precipitation Index, 1895–1991, as Computed by the National Climatic Data Center. *Above median precipitation was measured nationally for the second consecutive year following three years of near or below normal totals. Nationally, 1991 was the 17th wettest year observed since records began.*

**TEMPERATURE RANKINGS FOR 1991, BASED ON THE
PERIOD 1895 TO 1991. 1 = COLDEST AND 97 = WARMEST.**

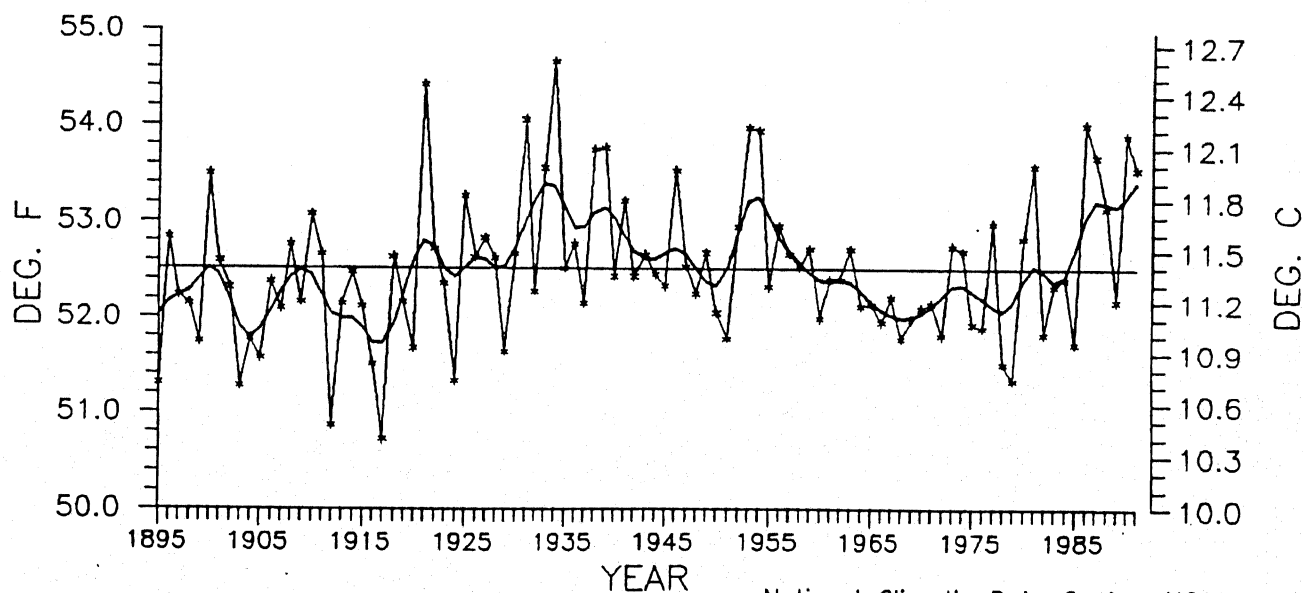
<u>STATE</u>	<u>RANK</u>	<u>STATE</u>	<u>RANK</u>	<u>STATE</u>	<u>RANK</u>	<u>STATE</u>	<u>RANK</u>
AL	66	IA	79	NE	83	RI	95
AZ	70	KS	85	NV	70	SC	83
AR	72	KY	95	NH	94	SD	87
CA	72	LA	66	NJ	95	TN	81
CO	59	ME	67	NM	28	TX	48
CT	95	MD	96	NY	93	UT	50
DE	96	MA	94	NC	93	VT	92
FL	92	MI	93	ND	92	VA	94
GA	79	MN	87	OH	95	WA	76
ID	71	MS	64	OK	78	WV	95
IL	85	MO	85	OR	81	WI	83
IN	91	MT	89	PA	94	WY	74

National Climatic Data Center

Top 10 rankings : **BOLD**

Bottom 10 rankings : *Italics*

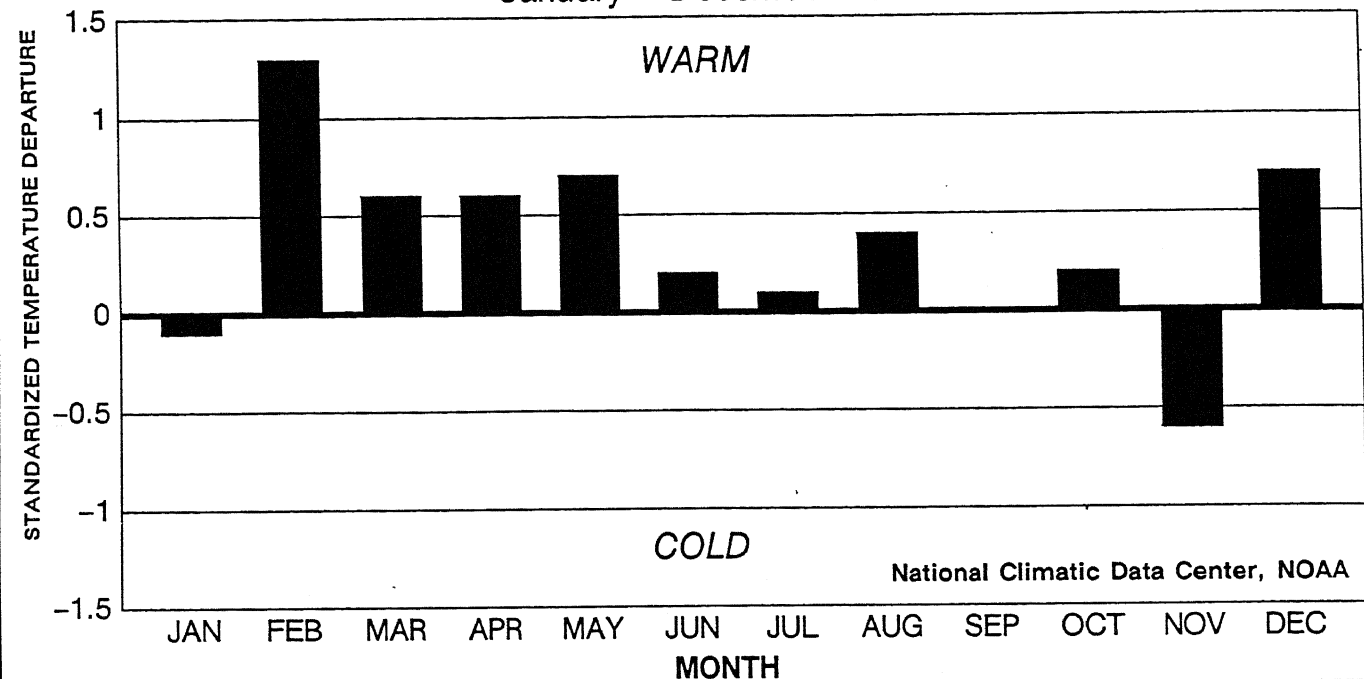
U.S. NATIONAL TEMPERATURE
JANUARY–DECEMBER, 1895–1991



Annual Nationally Averaged Temperatures, By Year, 1895–1991, as Computed by the National Climatic Data Center. Preliminary data for 1991 indicated that the annual average temperature across the contiguous U.S. was well above the long-term mean for the fifth time in the last six years. 1991 ranked as one of the ten warmest years on record in twenty states, with the nation as a whole experiencing the thirteenth warmest year since 1895.

U. S. NATIONAL TEMPERATURE INDEX

January - December 1991



According to the U.S. National Monthly Temperature Index (above), only two of the 12 months in 1991 brought below normal nationally-averaged temperatures. Five months (February-May and December) of exceptional warmth were reported, with standardized departures exceeding $+0.5^{\circ}\text{F}$. The graph depicting areal coverage of significantly warm and cold conditions (below) shows that nearly half of the nation experienced abnormally mild conditions during February, with seven months bringing well above normal temperatures to at least 10% of the country. In contrast, more than one-tenth of the U.S. was exceptionally cold during only one month (November), and the first two months of the year generated no widespread unusually chilly conditions.

U. S. PERCENT AREA COVERED BY VERY WARM OR VERY COLD CONDITIONS

January - December 1991

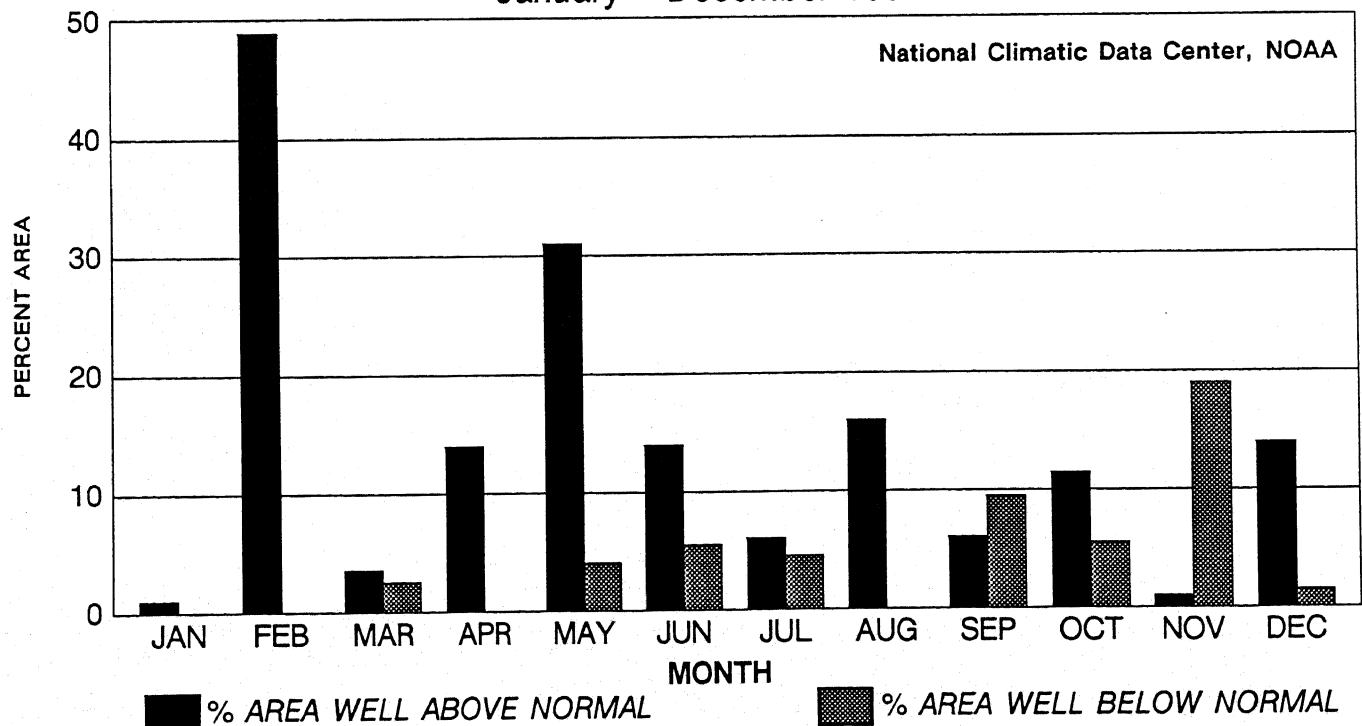
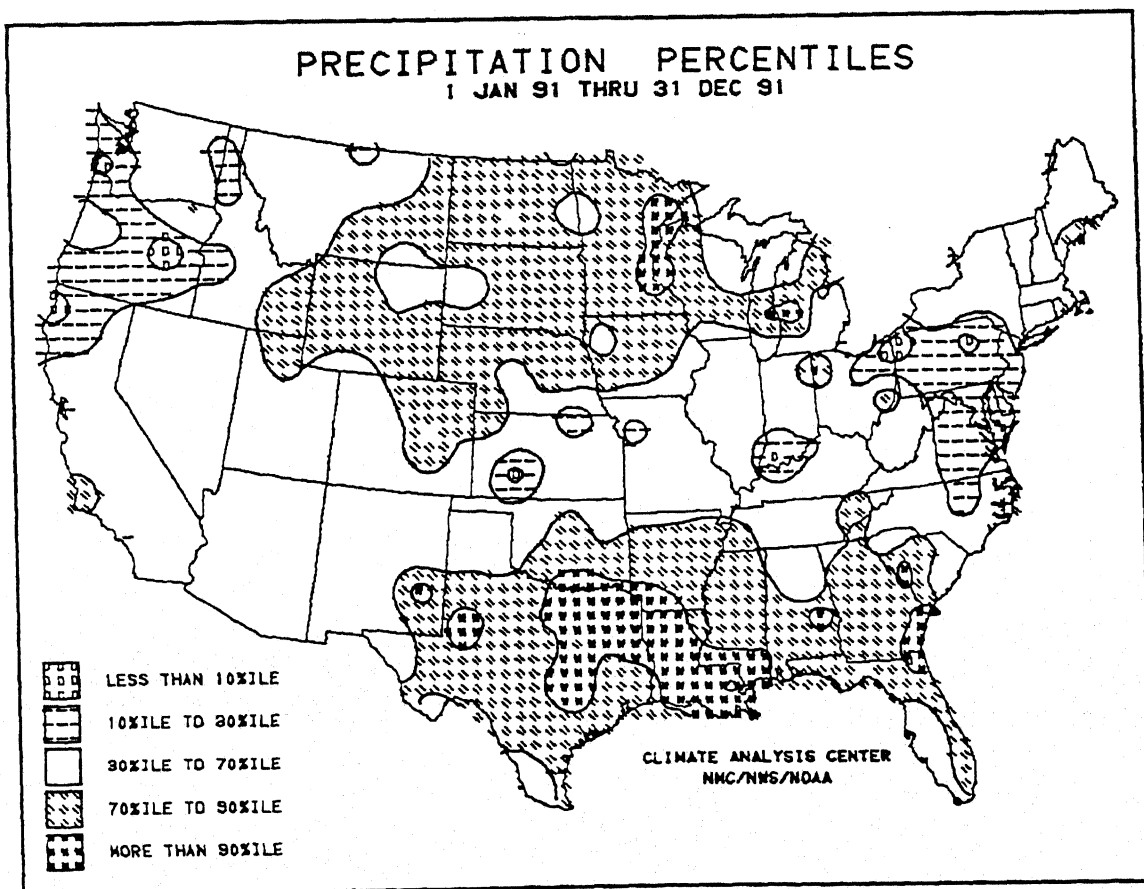


TABLE 1. SELECTED STATIONS WITH 125% OR MORE OF THE NORMAL PRECIPITATION AND 60.00 INCHES OR MORE PRECIPITATION; OR, STATIONS WITH 75.00 INCHES OR MORE PRECIPITATION AND NO NORMALS DURING THE YEAR 1991.

<u>STATION</u>	<u>TOTAL</u> <u>(INCHES)</u>	<u>PCT. OF</u> <u>NORMAL</u>	<u>STATION</u>	<u>TOTAL</u> <u>(INCHES)</u>	<u>PCT. OF</u> <u>NORMAL</u>
YAKUTAT, AK	219.96	162.9	TUPELO, MS	77.13	***
NEW ORLEANS/MOISANT, LA	102.39	172.1	WEST PALM BEACH, FL	76.84	129.1
NEW ORLEANS NAS, LA	98.85	***	ALEXANDRIA/ENGLAND AFB, LA	76.10	145.5
NEW ORLEANS/LAKE FRONT, LA	96.85	***	MUSCLE SHOALS, AL	74.75	144.9
KODIAK, AK	96.31	158.7	MERIDIAN, MS	73.54	137.9
APALACHICOLA, FL	90.78	165.1	BATON ROUGE, LA	71.00	127.3
BOSSIER CITY/BARKSDALE, LA	83.90	***	LAKE CHARLES, LA	70.31	130.2
JUNEAU, AK	83.10	157.0	SAVANNAH, GA	68.41	137.5
SHREVEPORT, LA	81.99	187.7	VERO BEACH, FL	68.15	132.6
MOBILE, AL	81.69	126.8	MONTGOMERY, AL	67.65	138.2
PORT ARTHUR, TX	81.38	147.8	DAYTONA BEACH, FL	67.19	138.7
JACKSONVILLE, FL	79.66	154.6	GREENWOOD, MS	66.53	125.5
BILOXI/KEESLER AFB, MS	78.48	130.5	COLUMBIA, SC	62.43	127.0
VALPARAISO/EGLIN AFB, FL	78.25	126.3	PALACIOS, TX	61.64	141.3
MONROE, LA	77.98	157.4	HOUSTON, TX	61.08	132.0
MILTON/WHITING NAS, FL	77.30	***			

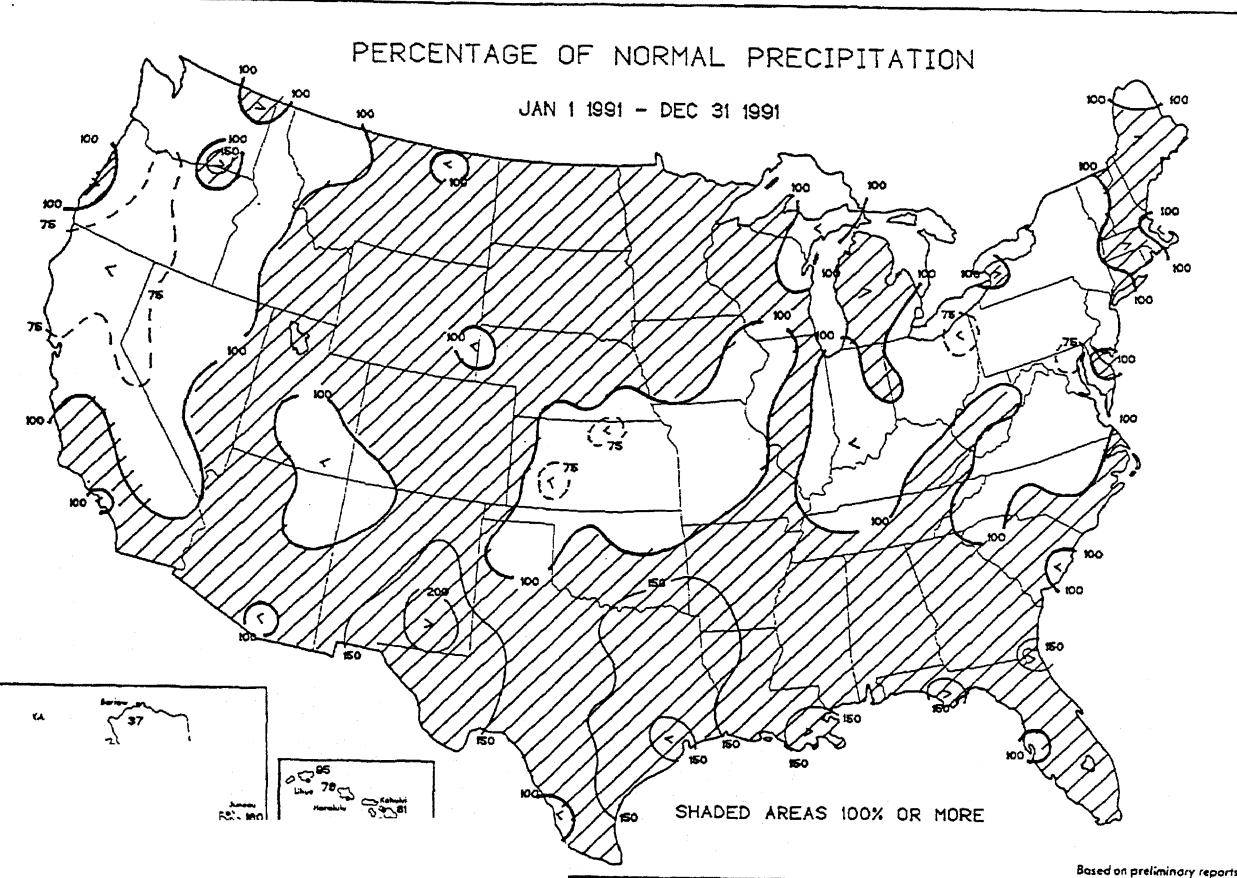
NOTE: Stations without precipitation normals are indicated by asterisks.



Annual 1991 Precipitation Percentiles. Much of the deep South and north-central states experienced significant annual wetness [$>70\%$ ile] during 1991. Eastern Texas and the lower Mississippi Valley, plagued at times with severe river and flash flooding, were especially wet [$>90\%$ ile], with portions of the Louisiana Bayou measuring over 100 inches of total precipitation. In sharp contrast, climatologically significant dryness [$<30\%$ ile] afflicted the Pacific Northwest, the mid-Atlantic, and portions of the central Great Plains and Ohio Valley.

TABLE 2. SELECTED STATIONS WITH 80% OR LESS OF THE NORMAL PRECIPITATION AND NORMAL PRECIPITATION OF 18.00 INCHES OR MORE DURING THE YEAR 1991.

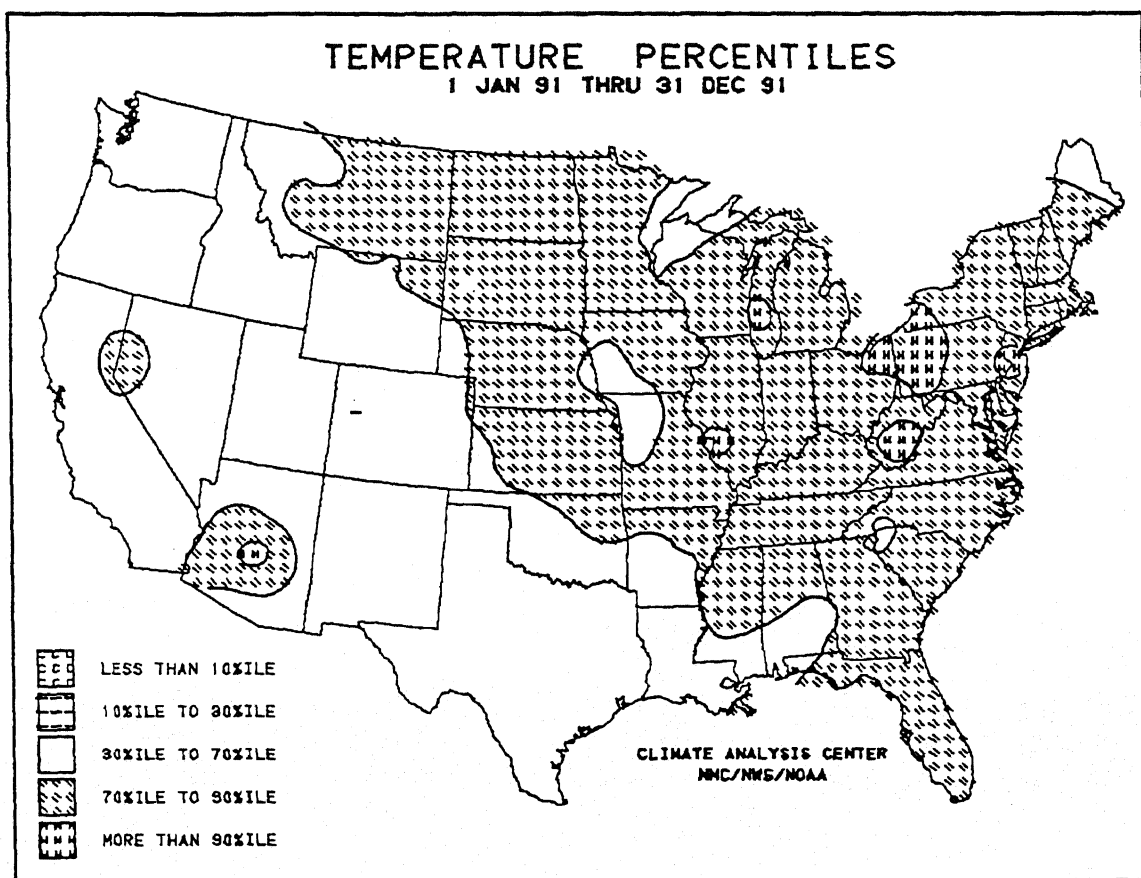
STATION	TOTAL (INCHES)	PCT. OF NORMAL	NORMAL (INCHES)	STATION	TOTAL (INCHES)	PCT. OF NORMAL	NORMAL (INCHES)
DODGE CITY, KS	11.35	55.6	20.40	KANSAS CITY/INTL, KS	28.75	79.7	36.07
DAVENSFORD, OR	14.51	74.0	19.61	MORGANTOWN, WV	29.19	71.9	40.59
LANCORDERIA, KS	19.96	73.6	27.11	WASHINGTON, DC	29.69	76.6	38.78
DAYTON, OH	21.16	63.5	33.31	ZANESVILLE, OH	30.15	78.6	38.36
REDA, CA	23.36	61.0	38.31	BALTIMORE, MD	30.27	72.7	41.63
DAYTON, OH	24.14	67.7	35.65	ERIE, PA	31.70	79.4	39.91
POCONO, PA	24.22	66.7	36.33	HARRISBURG, PA	31.23	79.8	39.11
WHEELERSBURG, WV	24.51	67.3	36.44	WILLIAMSPORT/LYCOMI, PA	31.69	77.2	41.05
WHEELING, OH	25.24	68.1	37.09	EVANSVILLE, IN	32.72	78.7	41.56
DAYTON, OH	25.61	62.5	40.95	HAMPTON/LANGLEY, VA	34.44	75.6	45.55
DAYTON, OH	27.14	77.8	34.87	STAMPEDE PASS, OR	73.97	79.9	92.57
DAYTON, OH	28.15	72.0	39.10	ALLENTOWN, PA	34.39	78.0	44.07



isopleths drawn for 75, 100, 150, and 200 percent. The United States experienced above normal precipitation, illustrated in the southern Rockies, upper Rio Grande Valley. In contrast, the lowest percentages were in California and central Oregon and in parts of Kansas, Ohio,

TABLE 3. THE YEAR 1991 AVERAGE TEMPERATURE 3.0°F OR MORE ABOVE NORMAL.

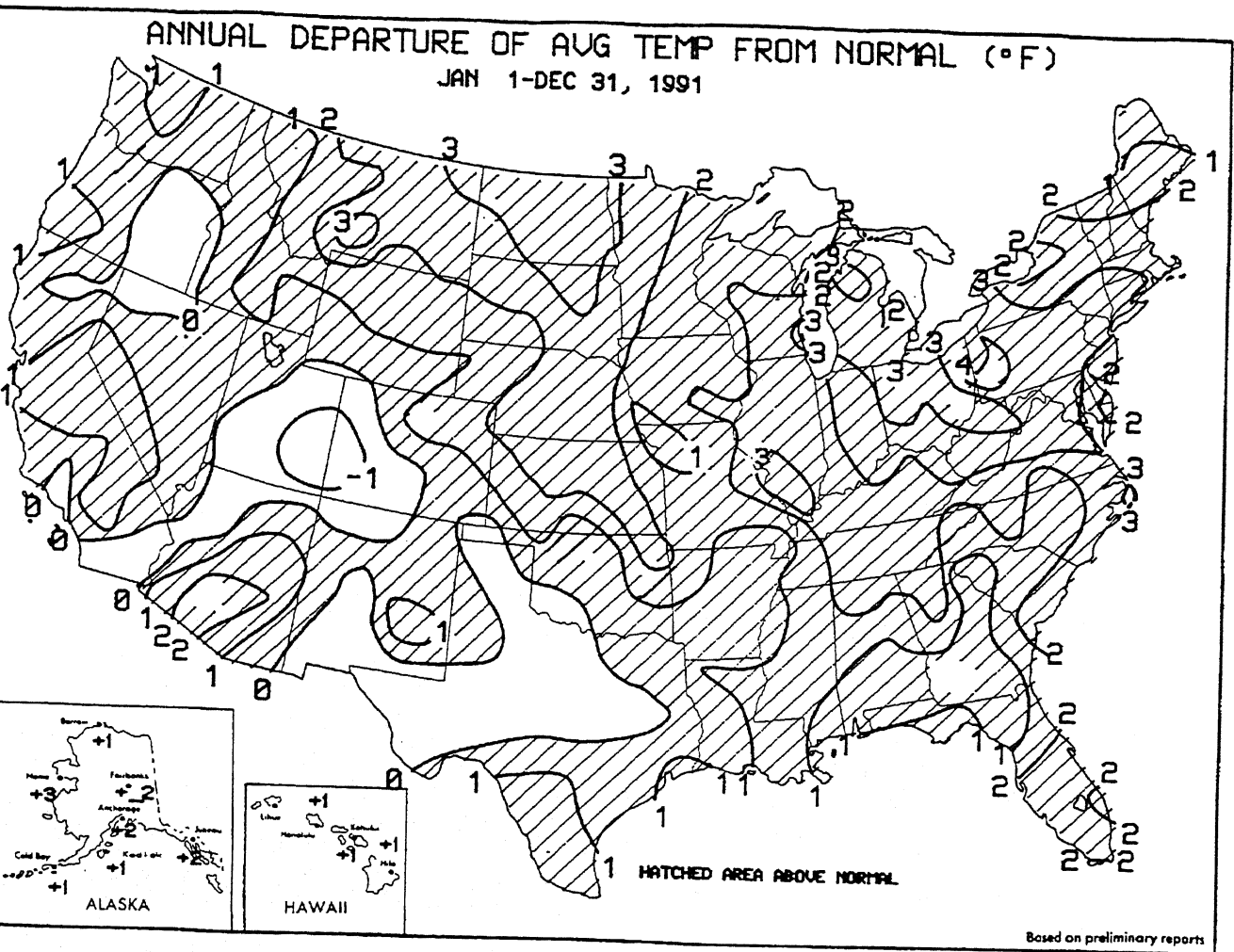
<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)	<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)
ERIE, PA	+4.3	52.4	TRAVERSE CITY, MI	+3.4	48.1
VICTORVILLE/GEORGE AFB, CA	+3.9	63.4	CHARLESTON, WV	+3.3	58.3
DEVIL'S LAKE, ND	+3.9	42.3	TOLEDO, OH	+3.3	52.3
PHOENIX, AZ	+3.8	75.1	DETROIT, MI	+3.3	52.1
ST LOUIS, MO	+3.8	59.3	YOUNGSTOWN, OH	+3.3	51.7
PHILADELPHIA, PA	+3.7	58.1	BRADFORD, PA	+3.3	46.9
PITTSBURGH, PA	+3.7	54.4	CHARLOTTE, NC	+3.2	63.4
AKRON, OH	+3.7	53.3	BISMARCK, ND	+3.2	44.7
MILWAUKEE, WI	+3.7	50.1	PELLSTON, MI	+3.2	44.7
BECKLEY, WV	+3.6	54.4	JAMESTOWN, ND	+3.2	43.7
LOUISVILLE/STANDIFORD, KY	+3.5	59.8	ABERDEEN, SD	+3.1	46.1
NEW YORK/LA GUARDIA, NY	+3.5	58.0	GRAND FORKS, ND	+3.1	42.1
COLUMBUS, OH	+3.5	55.4	BIG DELTA, AK	+3.1	30.8
VALDEZ, AK	+3.5	39.6	BINGHAMTON, NY	+3.0	48.9
CAPE HATTERAS, NC	+3.4	65.5	GLASGOW, MT	+3.0	45.1



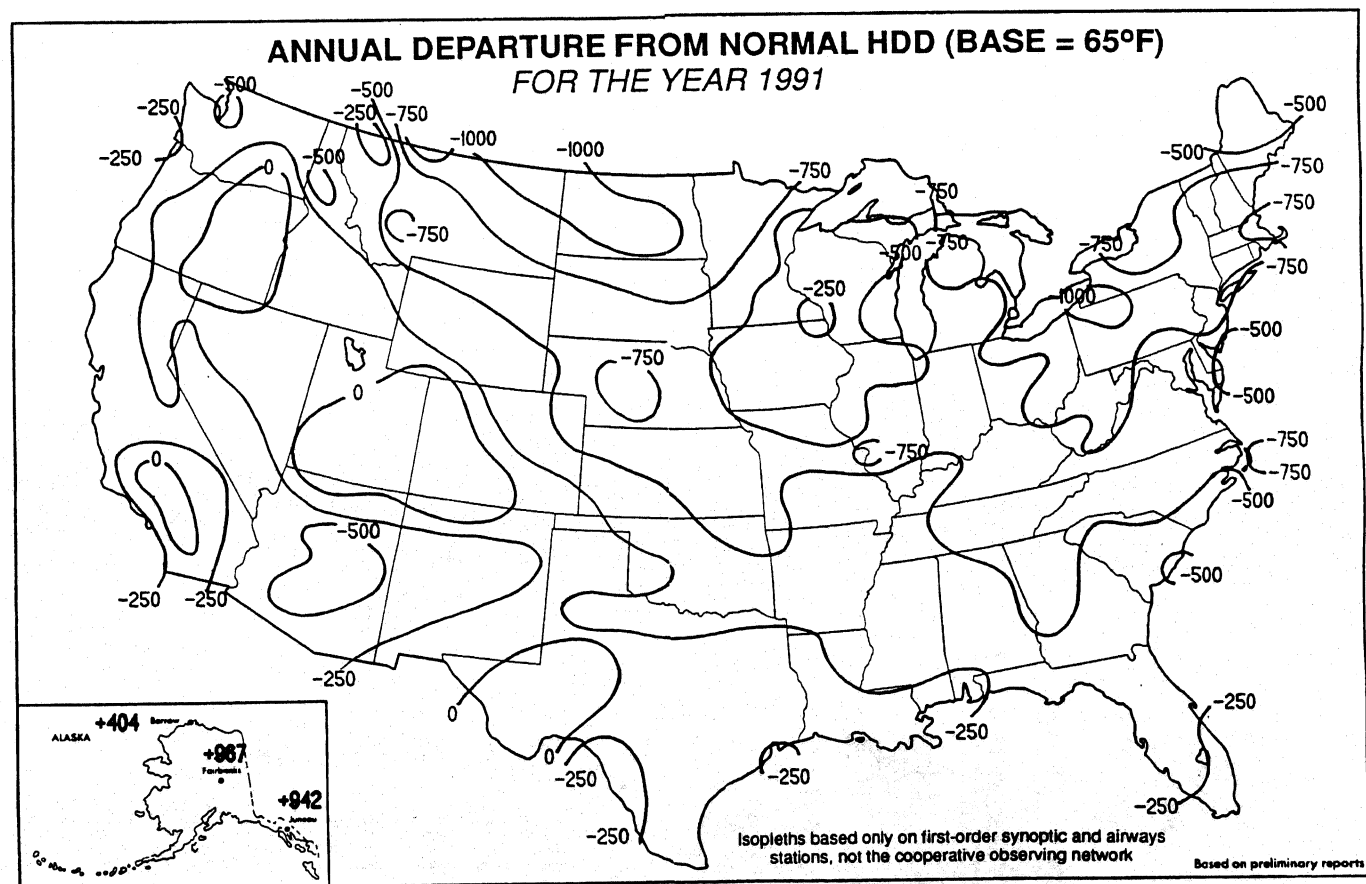
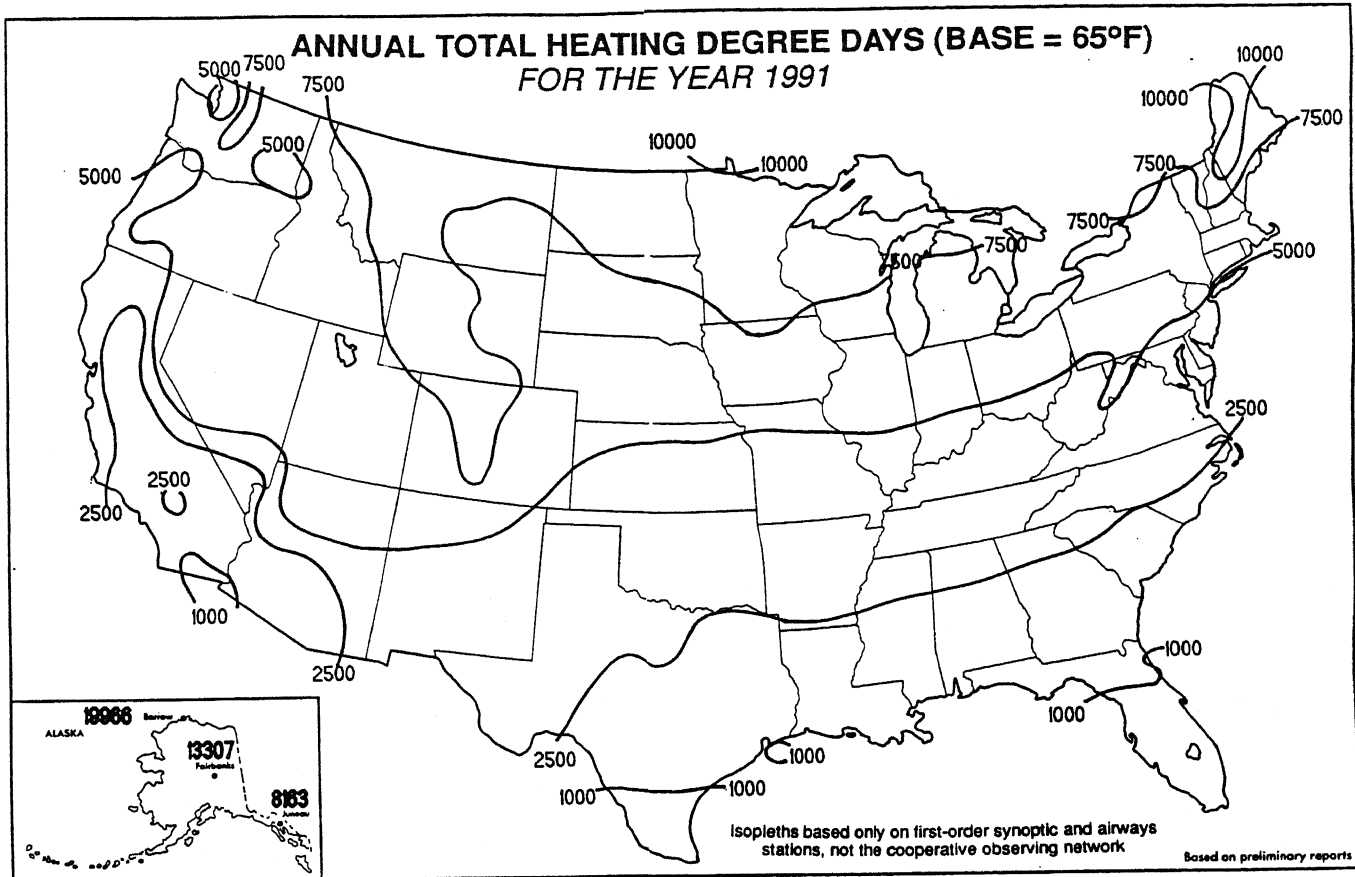
Annual 1991 Temperature Percentiles. Most of the eastern half of the country, the northern and central Plains, and portions of the Far West observed significant warmth [$>70\%$ ile] during the year. Substantially below normal average temperatures for 1991 were absent nationwide.

TABLE 4. THE YEAR 1991 AVERAGE TEMPERATURE 0.5°F OR MORE BELOW NORMAL.

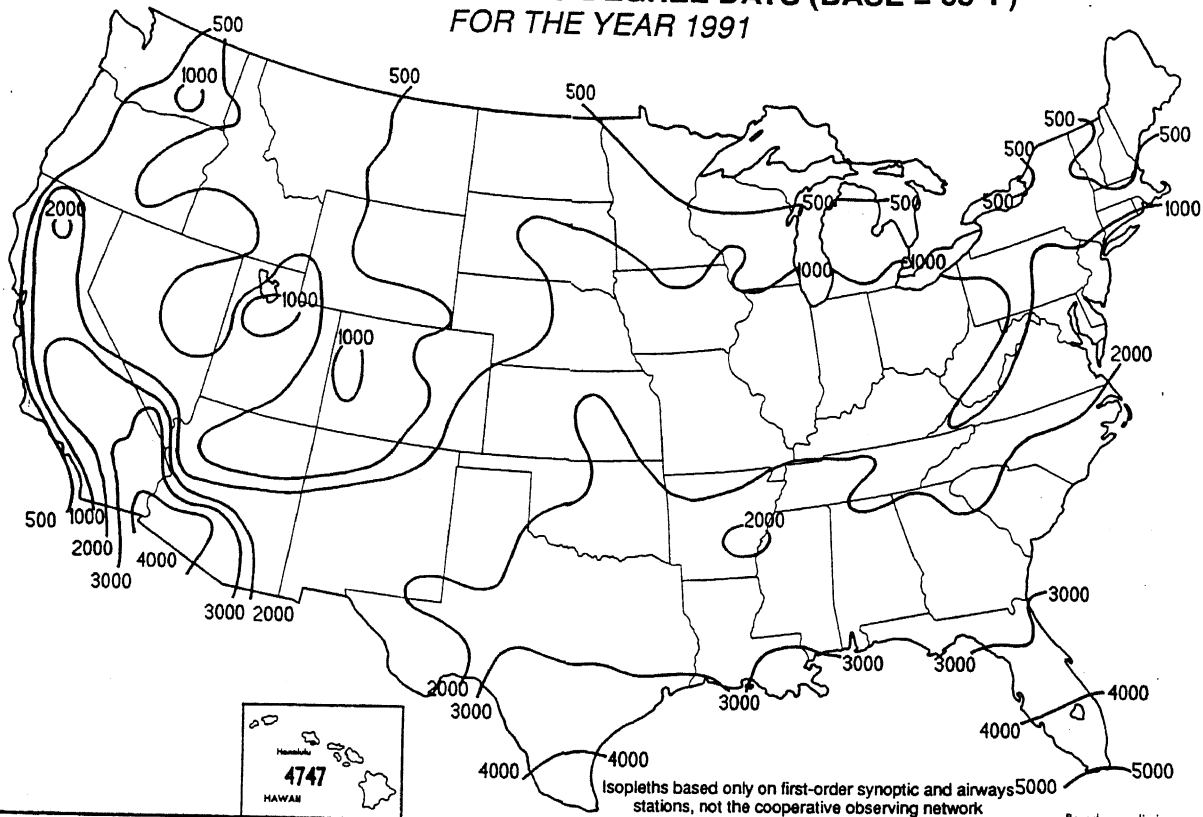
<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)	<u>STATION</u>	<u>DEPARTURE</u> (°F)	<u>AVERAGE</u> (°F)
ALAMOSA, CO	-1.4	39.9	EL PASO, TX	-0.7	63.0
GRAND JUNCTION, CO	-1.4	51.3	BLYTHE, CA	-0.7	72.7
REDDING, CA	-1.1	62.8	DELTA, UT	-0.6	50.1
BURNS, OR	-1.0	45.7	FARMINGTON, NM	-0.6	51.4
OAKLAND, CA	-0.9	56.6	CEDAR CITY, UT	-0.5	49.9
DEMING, NM	-0.9	59.4	WALLA WALLA, WA	-0.5	53.5
SAN DIEGO/LINDBERGH, CA	-0.9	62.9	FT SILL/HENRY POST AAF, OK	-0.5	61.8
SAN ANGELO, TX	-0.9	64.7	MIDLAND, TX	-0.5	63.0
PENDLETON, OR	-0.8	51.8	WINK, TX	-0.5	63.8
IMPERIAL, CA	-0.8	72.4	THERMAL, CA	-0.5	72.0



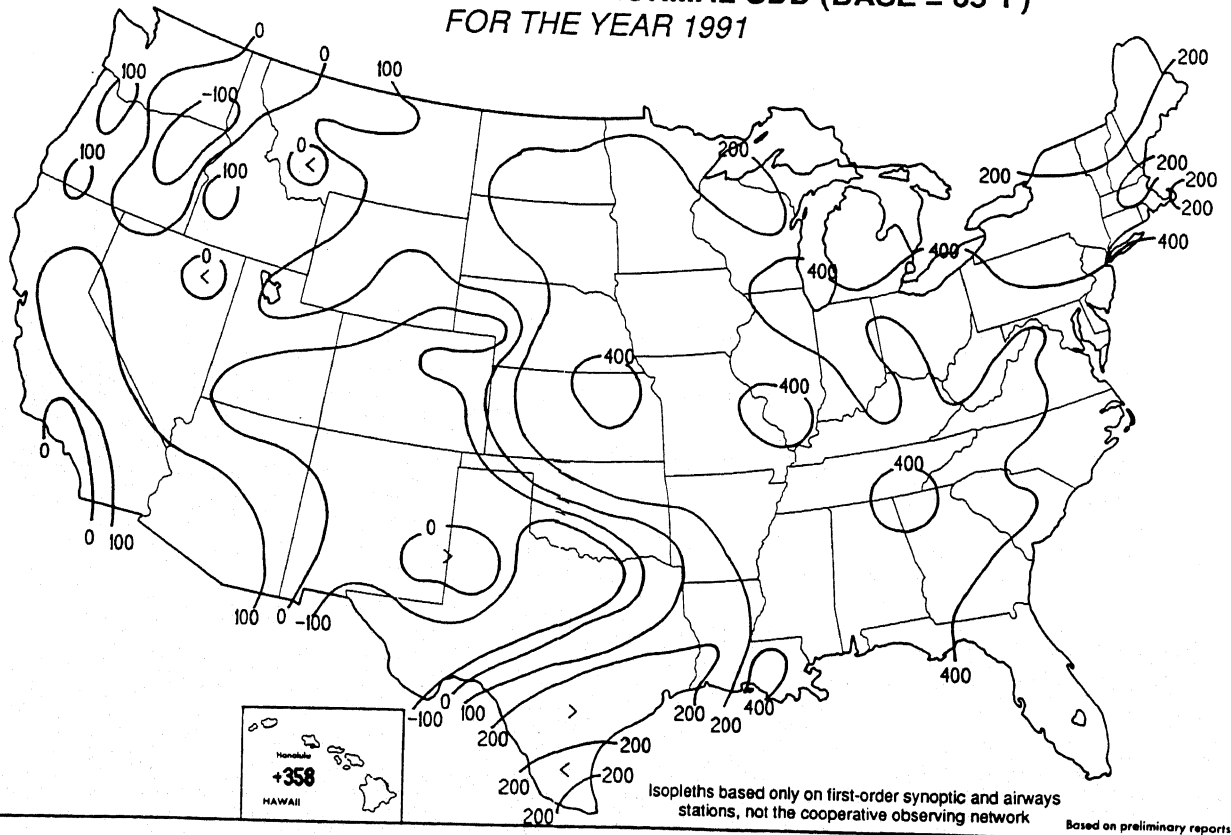
Annual 1991 Departure of Average Temperature from Normal (°F). Isotherms drawn for -1°F, 0°F, 2°F, and 4°F. There were few areas of the country with subnormal annual temperatures. The largest positive departures (more than 3°F) were found in the northern Plains, eastern Corn Belt, and mid-Atlantic.



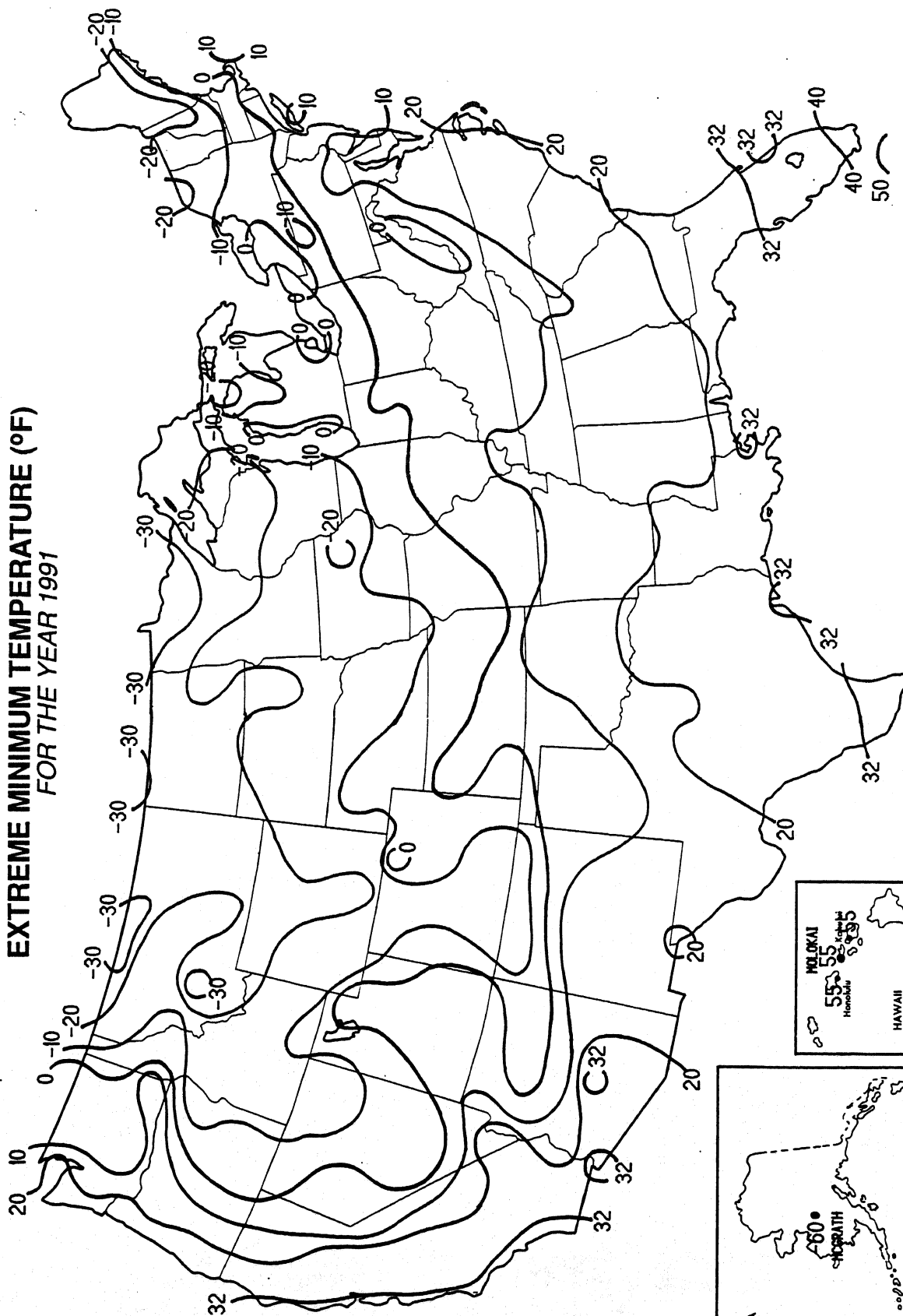
**ANNUAL TOTAL COOLING DEGREE DAYS (BASE = 65°F)
FOR THE YEAR 1991**



**ANNUAL DEPARTURE FROM NORMAL CDD (BASE = 65°F)
FOR THE YEAR 1991**



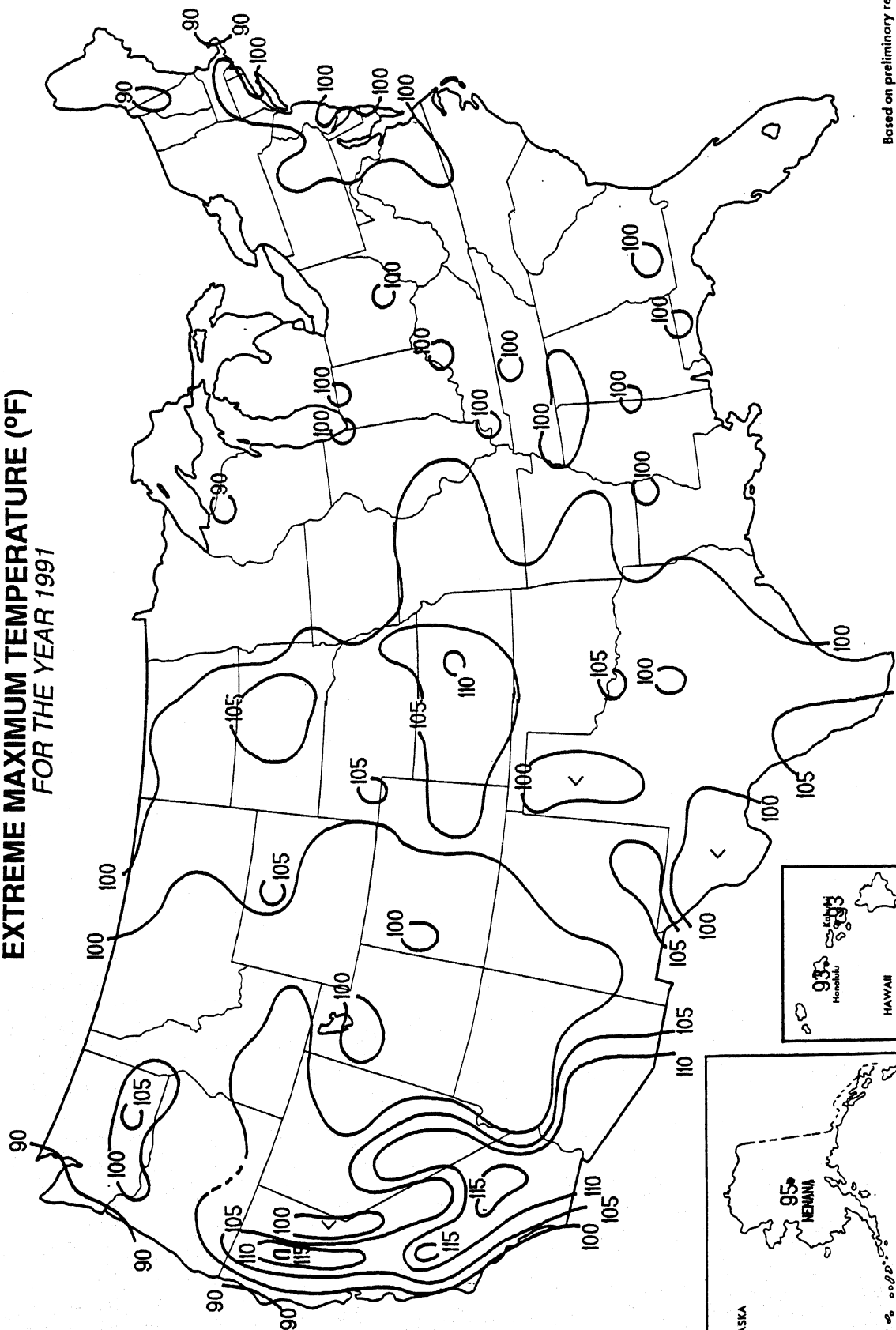
EXTREME MINIMUM TEMPERATURE (°F) FOR THE YEAR 1991



Based on preliminary reports

Extreme Minimum Temperatures (°F) during 1991. Isotherms were drawn from a network of several hundred stations consisting of first-order synoptic and airports stations (NOT cooperative stations). Isotherms were drawn only for -30°F, -20°F, -10°F, 0°F, 10°F, 20°F, 32°F, 40°F and 50°F. Temperatures dipped below freezing across all of the contiguous United States, except for most of southern Florida, extreme southern Texas, and the immediate California coast. Bitterly cold conditions gripped the northern Rockies, extreme northern Plains, and northern and central Alaska.

EXTREME MAXIMUM TEMPERATURE (°F) **FOR THE YEAR 1991**



Based on preliminary reports

Extreme Maximum Temperatures (°F) during 1991. Isotherms were drawn from a network of several hundred stations consisting of first-order synoptic and airports stations (NOT cooperative stations). Isotherms were drawn only for 90°F, 100°F, 105°F, 110°F and 115°F. Much of the eastern half of the nation observed relatively low extreme maximums even though 1991 was the thirteenth warmest year on record nationally. In contrast exceptionally hot conditions affected the Far West, the northern and central Great Plains, and northern and central Alaska.

EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC ADVISORY 92/01

issued by

**DIAGNOSTICS BRANCH
CLIMATE ANALYSIS CENTER, NMC**

JANUARY 13, 1992

The development of enhanced convection in the central equatorial Pacific during the last two months signifies the onset of the mature phase of a Pacific warm (ENSO) episode. Consistent with this evolution, drier than normal conditions have been observed in many sections of the Philippines, Indonesia and northern Australia. Wetter than normal conditions have been observed in the central equatorial Pacific, over northern Mexico and the southern United States, and over South America. These features, inferred from the outgoing longwave radiation anomalies obtained from NOAA's polar orbiting satellites (Fig. 1), are consistent with those generally found at this time of year during the mature phase of warm (ENSO) episodes (Fig. 2).

Sea surface temperature anomalies in the eastern and central equatorial Pacific increased during December, with the greatest anomalies (greater than $+2^{\circ}\text{C}$) found along the equator near 160°W (Fig. 3). At the same time, the oceanic thermocline was deeper than normal in the central and eastern equatorial Pacific, and shallower than normal in the western equatorial Pacific. These features are similar to those observed during the mature phase of the 1986–1987 warm (ENSO) episode.

There are certain features of the present warm episode which are evolving differently from the 1986–1987 warm episode. The sea surface temperature anomalies in December 1991 were greater than those observed in December 1986. Also, the area of enhanced convection (cloudiness and precipitation) during November and December 1991 was shifted farther east than was observed during late 1986. Finally, the low-level easterlies in the central equatorial Pacific have been substantially weaker during the last two months than at any time during the 1986–1987 warm episode.

During the next three months our attention will be focused on the evolution of both the enhanced convection in the central Pacific and the positive SST anomalies in the eastern equatorial Pacific, especially along the South American coast. Positive SST anomalies can have a strong impact on the distribution of cloudiness and precipitation throughout the eastern equatorial Pacific at the time of year (February–April) when sea surface temperatures are seasonally highest.

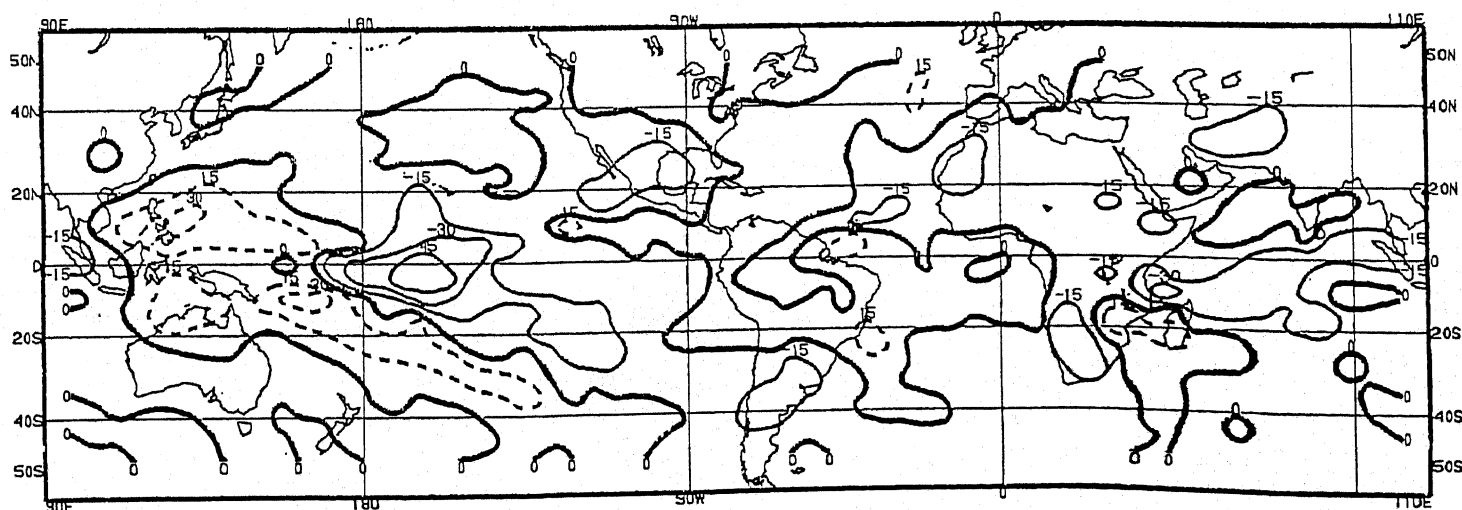


FIGURE 1. Outgoing longwave radiation (OLR) anomalies for December 1991. Negative (positive) values in the tropics denote stronger (weaker) than normal convection. Contour interval is 20 Wm^{-2} . Contours of 280 Wm^{-2} and above are dashed. Anomalies are computed as departures from the 1979–1988 base period mean. Anomaly contour interval is 15 Wm^{-2} . Positive anomalies are dashed.

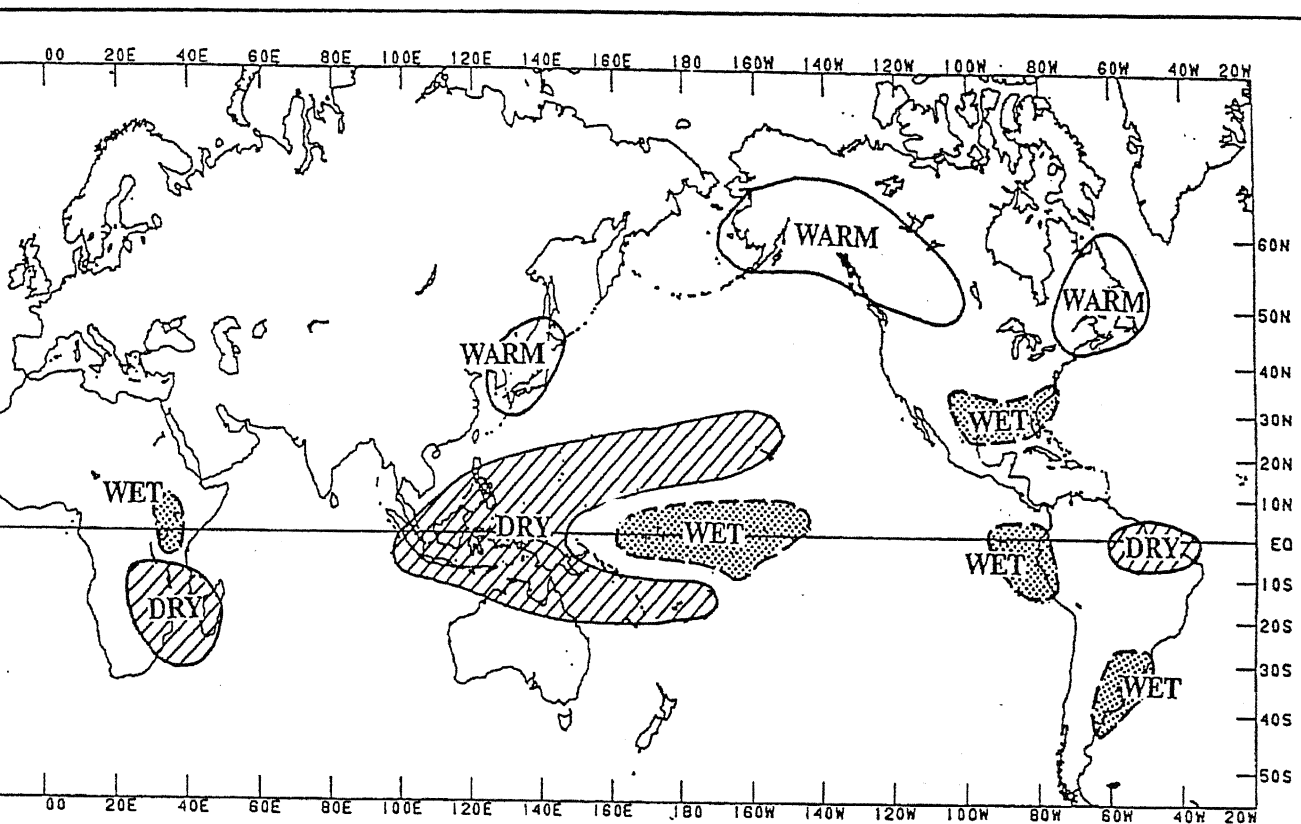


FIGURE 2. Temperature and precipitation anomaly patterns generally found during November – March in warm (ISO) episodes.

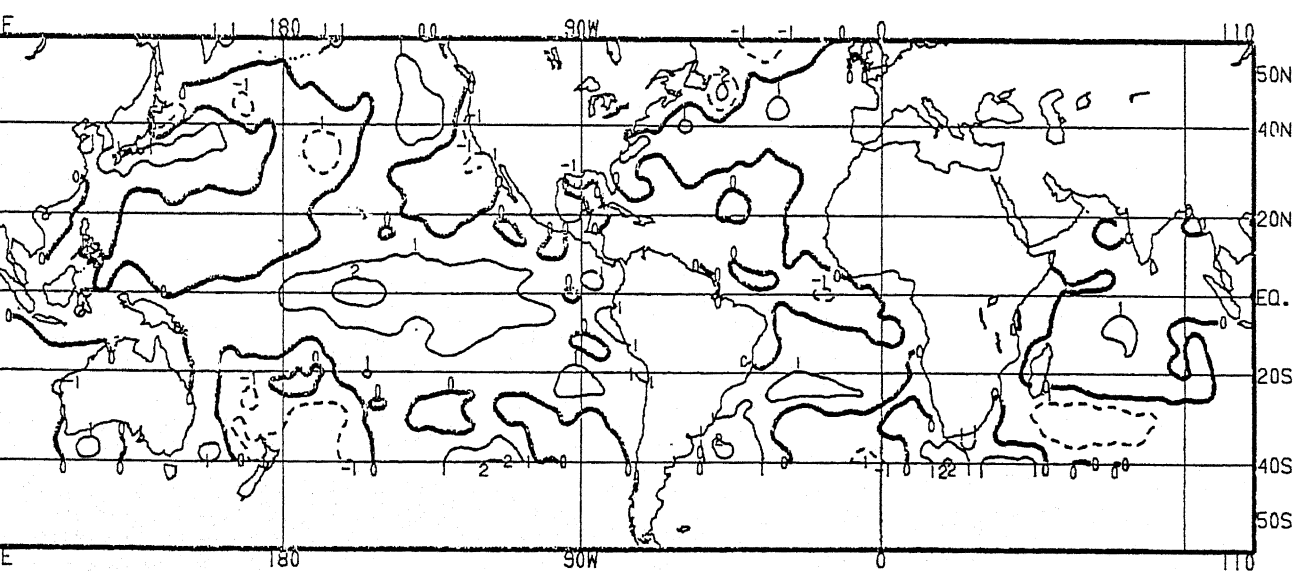


FIGURE 3. Sea surface temperature anomalies for December 1991. Contour interval is 1°C. Negative values are indicated by dashed contours.

